

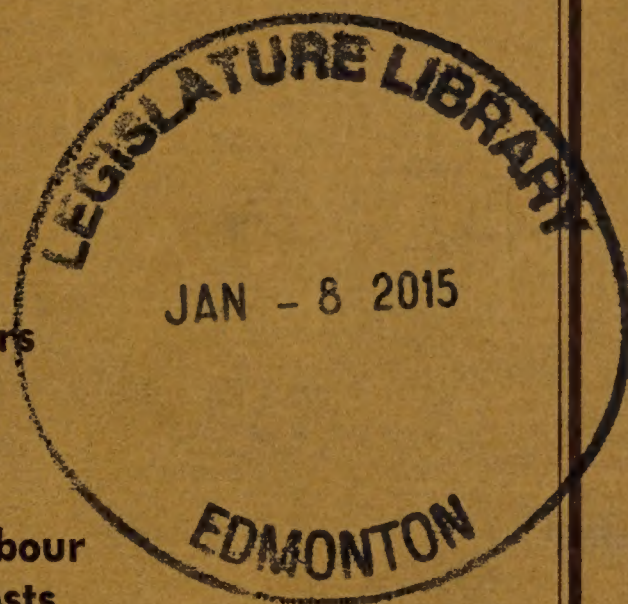
ALBERTA'S ECONOMIC PROSPECTS

GOVERNMENT OF THE PROVINCE OF ALBERTA



Contributors:

University of Alberta
Research Council of Alberta
Department of Agriculture
Department of Economic Affairs
Department of Education
Department of Public Health
Department of Highways
Department of Industries and Labour
Department of Lands and Forests
Department of Mines and Minerals
Department of Municipal Affairs
Department of Provincial Treasury
Department of Public Welfare
Department of Public Works
Petroleum and Natural Gas Conservation Board
Water Resources and Irrigation
Alberta Power Commission



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This report on Alberta's Economic Prospects is a joint effort prepared with the view of tracing the development of Alberta's social and economic life over the past fifty years, and taking a forward look as to the probable trends in development during the next twenty or thirty years. The immediate purpose of the study was to provide a brief for discussion at hearings of the Gordon Royal Commission. This document is a revision of that brief.

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DEPARTMENT OF ECONOMIC AFFAIRS

HON. A. RUSSELL PATRICK
Minister

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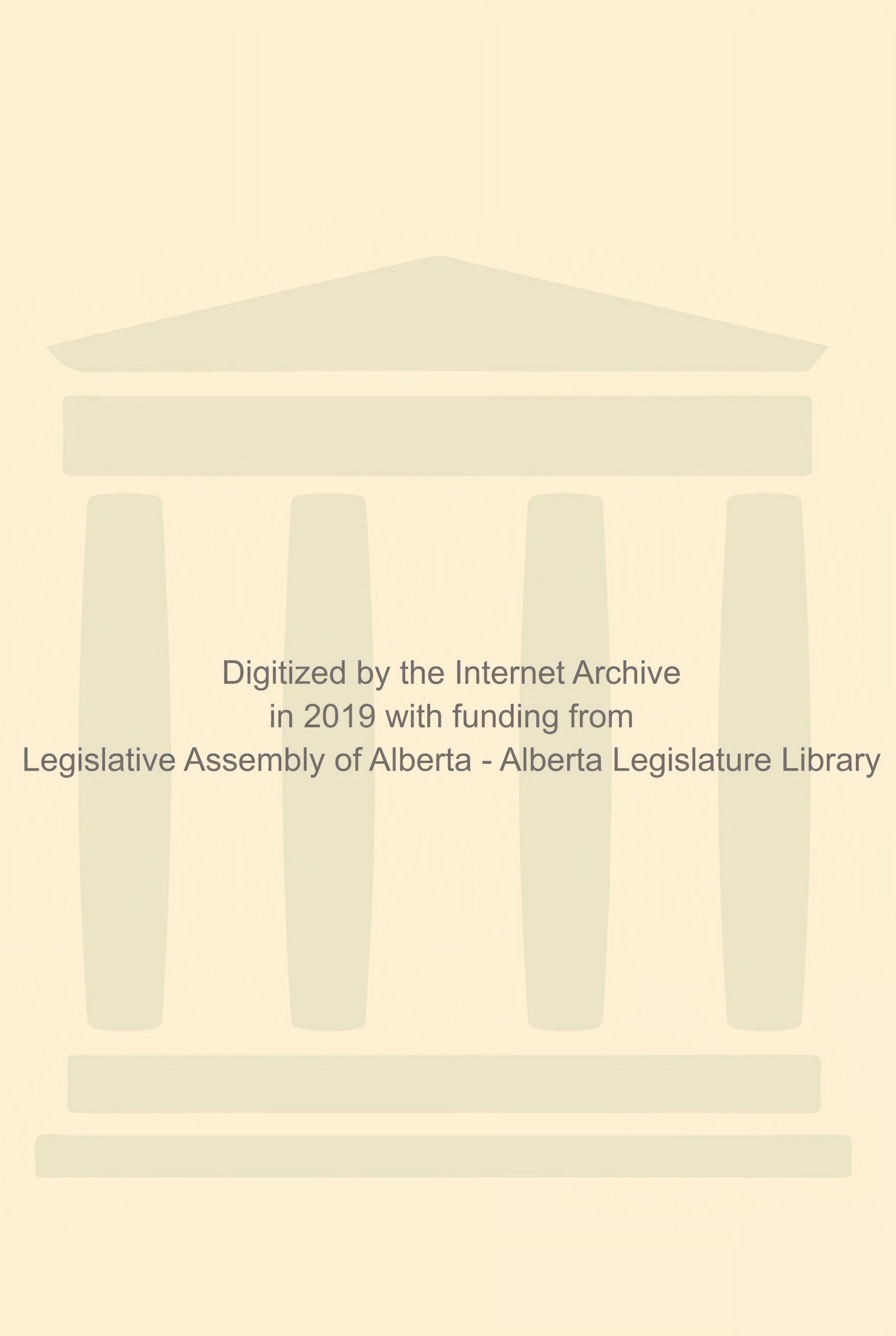
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FOREWORD

Reference is made to the Royal Commission on Canada's Economic Prospects in "Hansard", June 17, 1955. The Prime Minister of Canada stated in a report that it was desirable that the Canadian people should be more fully informed of the long term economic prospects of Canada, and that it was in the national interest to initiate, examine and publish studies of Canada's economic potentialities, including developments in productive capacity, the growth and distribution of population, the direction and nature of our internal and external trade, progress in standards of living, and expanding requirements for industrial and social capital.

The membership of the Royal Commission is as follows: Walter L. Gordon, Chairman, A. E. Grauer, Andrew Stewart, Raymond Gushue and Omer Lussier.

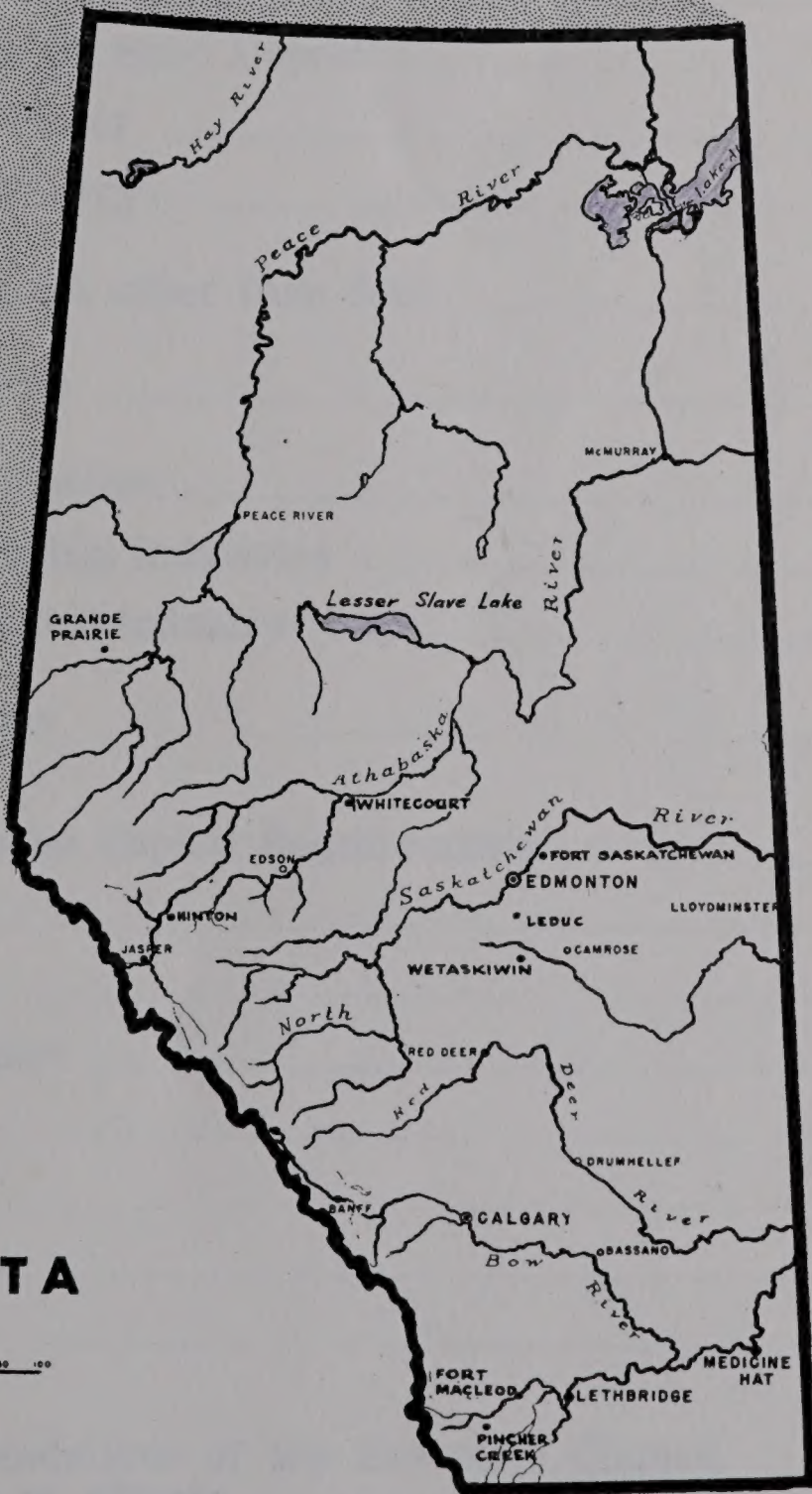
Mr. Gordon in talks with the Honourable Ernest C. Manning, Premier of Alberta, requested the co-operation of his Government in preparing certain information which would be useful to Alberta and helpful to the work of the Commission. Accordingly, the Honourable A. Russell Patrick, Minister of the Department of Economic Affairs, initiated this study of Alberta's Economic Prospects. Mr. Ralph R. Moore, Deputy Minister, and Mr. R. Martland, Director of the Industrial Development Board, arranged the initial details. The timing coincides with Alberta's Golden Jubilee. Fifty years have passed since this province was created as a part of the Canadian nation. This study examines the major trends of those past fifty years and takes a forward look at the direction the economy may be expected to take over the next twenty or thirty years. Obviously these projections will need to be adjusted to meet new and changed conditions. But having marked out the path, such adjustments should be relatively easy to make as the need arises. The natural resources of Alberta, and particularly the tremendous reserves of oil, gas, coal and other energy fuels, are almost certain to bring about further industrial expansion.

Grateful acknowledgment is due the University of Alberta, the Research Council of Alberta, the Petroleum and Natural Gas Conservation Board, and all departments of the government of the Province of Alberta for their help. Acknowledgment is also due Mr. W. E. Simpson, Q.C., for his study on the Canadian tax structure and certain policy questions. In addition, Dr. N. H. Grace, Director of the Research Council of Alberta helped wherever there were problems to be solved.

Thanks and appreciation are due all those responsible for each submission. Such excellent results, in so short a time, could not have been achieved except by scientists who are the recognized research leaders in these fields in the Province of Alberta.

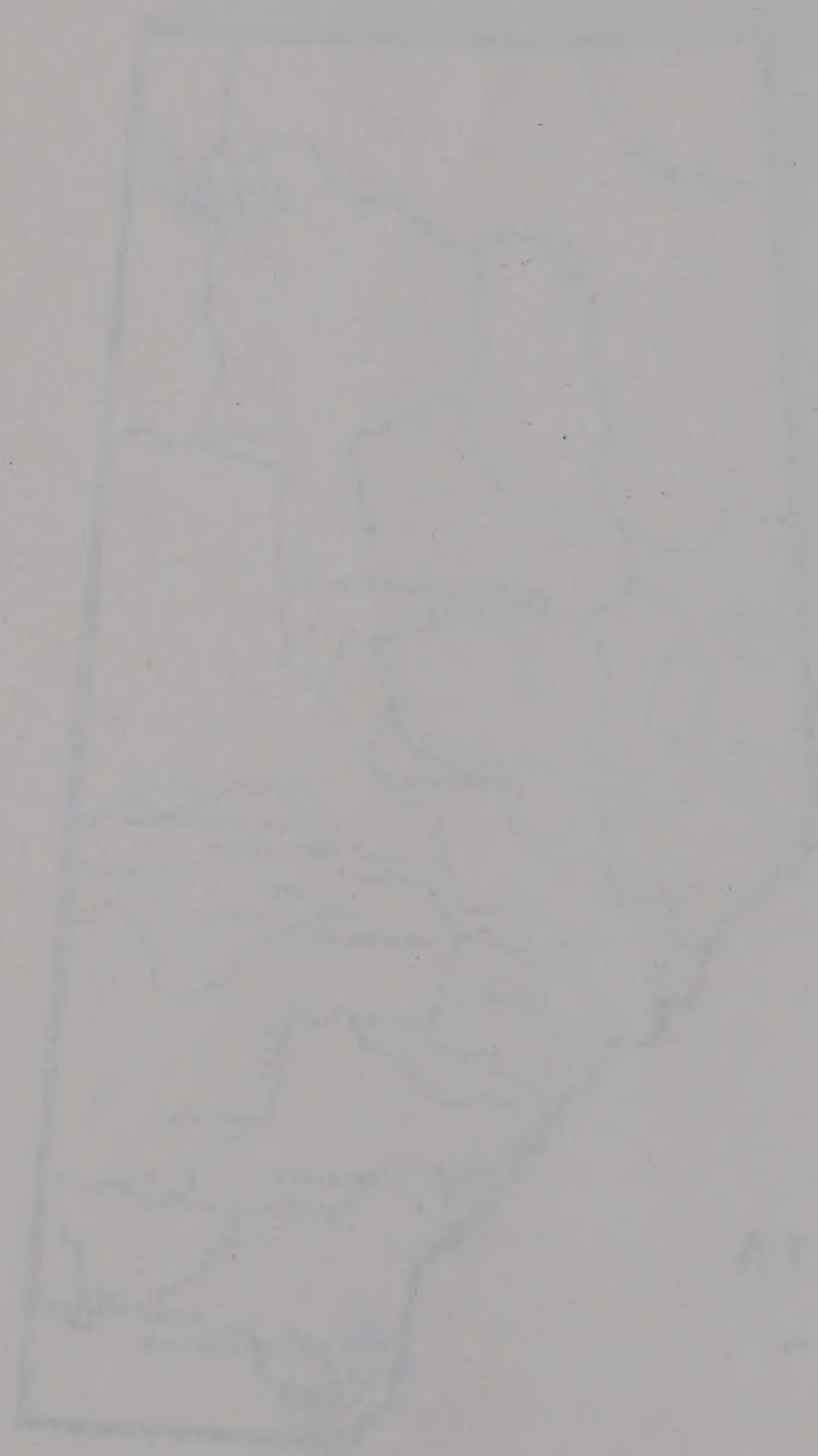
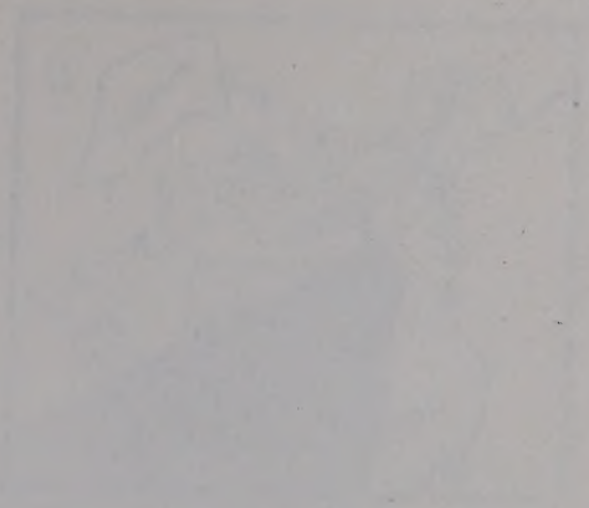
Lawrence E. Kindt, B.Sc., M.A., Ph.D.,
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Calgary, Alberta.

December, 1955.



ALBERTA

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Edmonton, Alberta, Canada — \$4.00 per copy.



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Reierson, Hon. R.	Minister of Industries and Labour

Alberta's Economic Prospects

**POPULATION AND THE LABOUR FORCE OF ALBERTA
1906 - 1985**

Prepared by

Alberta Bureau of Statistics
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DEPARTMENT OF INDUSTRIES AND LABOUR

**HON. R. REIERSON,
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**J. E. OBERHOLTZER,
Deputy Minister.**

December, 1955

S U M M A R Y

Experience of 45 years indicates that 15 to 20 per cent of the native Albertans leave for other provinces or for the U.S.A. Increased industrialization and improved social amenities will undoubtedly serve to retain more of the native born and attract immigrants and it is expected that immigration and emigration will tend to balance. Thus the analysis of historical data leads to the conclusion that Alberta will retain approximately the equivalent of the natural increase of her population.

The projection is therefore based on natural increase and has been adjusted to conform to variations in the age composition of the 1951 population. It is estimated that Alberta will have 1,850,000 people in 1985.

As it is felt that increased industrialization, and local processing of raw materials of mine and field, are better in the long run for the country, the process can be hastened by embarking on a policy of actively stimulating industry. This in turn will stimulate population growth and further industrial development.

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Table 1. Population and Natural Increase 1905-1955.

Table 2. Population Projection—Alberta, 1960-1985.

Chart 1. Alberta Population 1905-51 and Projection of Population 1951-1985.

Charts 2, 3, 4, 5. Population Distribution by Age Groups, Alberta, 1951, 1955, 1975 and 1985.

Population — Alberta, 1906 - 1985

The factors which must be considered in a population projection are the birth and death rates, immigration from foreign countries, and interprovincial migration. These factors in turn are affected by favourable or unfavourable economic conditions. Population flows to the area where general economic conditions appear to be most favourable.

The prime factor to be considered in making a population projection is that of the rate of natural increase. Using 1951 population figures as a base, birth and death rates were applied to arrive at the projected 1985 population figure, which is in fact, a natural increase figure.

Substantial immigration from foreign countries or substantial net interprovincial migration from other provinces could result in an upward revision of the figures. If economic conditions in Alberta were unfavourable for the next three decades the province would not retain all of its natural increase and the projection would be high.

It is inevitable that the pace of growth both in population and industry of the provinces of Canada will be very uneven over the next 30 years. Different provinces may well assume leadership at different times. Therefore it is realistic to assume that there will be periods in which Alberta loses a fraction, large or small, of the natural increase as well as periods when the province will show net immigration from other provinces and other countries.

Since 1914 Europeans came to Canada in large numbers in the immediate post-war periods. As conditions returned to normal they were more loath to leave their home countries especially with policies of selective immigration and quotas in vogue on this side of the Atlantic. Now that most of the suitable arable land of the province has been settled, it is unlikely that there will be a substantial enough volume of immigration from foreign countries to materially affect the population estimates.

Interprovincial migration is undoubtedly a reflection of the feelings of individuals regarding economic opportunities, social security, social amenities available, and climate. It is a product of a never ending search of people for "greener pastures". However, constant net emigration from a given province to other provinces may reasonably be taken as an indication that economic and other conditions in that province are unfavourable. Provincial and federal governments can do much to ensure that a favourable economic climate exists for the encouragement of business and industry, and that social services are in line with those offered in other provinces. In a prairie province like Alberta favourable economic opportunities are essential to continued population growth.

In the early years of the province there was substantial migration from other provinces to Alberta. Such migration has by no means ceased of course, but the emphasis tends to be different. As economic conditions at times appeared more favourable elsewhere, a substantial number of native born Albertans moved to other provinces. In view of the types of natural resources of the province and in view of the fact that the economy

N.B.: Generally speaking absolute figures have been used in the "tables" which are included in this brief. However, in the text and commentary, figures have been rounded to the nearest thousand for ease in remembering and comprehending the data.

of the province is becoming better balanced, it has been assumed for the purposes of the projection that Alberta will either retain her own population or show a slight net gain from interprovincial migration.

The following general comments which are based on experience and on study of the growth of the economy of this province and of the country generally, may be of interest.

It may be taken as a general postulate that an increase in population is desirable up to the point where the population begins to press on natural resources. An increase in the size of local markets allows manufacturers to produce in quantity thus reducing costs and enabling them to compete with other centres. A larger population makes possible greater division of labour. It ensures larger local markets for the producers of primary products.

Population can be increased by two methods. The first is to depend exclusively on natural increase. The native born are accustomed from birth to the way of life and to the means of making a livelihood in the given environment and can be expected to remain. Alternatively the government can speed up the process by sponsoring a vigorous immigration policy. However, it takes time for the immigrants to adjust to the new environment.

If the federal government decides that increased industrialization and local processing of raw materials of mine and field are better in the long run for the country, the process can be hastened by embarking on a policy of actively stimulating industry and immigration and providing labour from immigrant sources.

* * *

The various factors which have been taken into consideration in arriving at the 1985 population figure, and the supporting data, are dealt with separately in the following pages.

METHOD OF PROJECTION:

The projection of population to 1985 was obtained by the following method:

(1) Using the 1951 population figure as a base; birth, death and natural increase rates* as shown in Table 2 were applied.

- (a) It will be noted that the birthrate was lowered for the period 1961-70 to correspond with the lower birthrate of the period 1930-40. Continental birthrates were lower in the 1930's, and as women of child-bearing age will be relatively fewer in number during the 1960's, there will naturally be a slight decline in birthrate.
- (b) The corresponding rise after 1970 reflects the period 1946-55 when the birthrate was high.
- (c) It is assumed that the deathrate will rise consistently over the next few years as the population as a whole tends to "age". The deathrate in Alberta since 1921 has been consistently lower than that of any other province in Canada with the exception of the Province of Saskatchewan. It is felt that this is caused by the fact that these two western prairie provinces had a "younger" population and that, therefore, as the province ages the deathrates in the two provinces will tend to rise toward the Canadian average.

* Birth, death and natural increase rates are the ratio of the absolute number of births, deaths, etc., in a specific year to the total population of that specific year, and are referred to as a rate per one thousand of total population.

(d) It was assumed that there will be no major wars or major economic depressions.

(2) The age distribution of population 1951 was obtained from Census of Canada—1951, Table 1, Appendix “A”, Volume II.

The age group distributions, 1975 and 1985, were arrived at by using “Canadian Life Tables 1951, Dominion Bureau of Statistics—Reference Paper No. 50”, and applying formulae and methodology outlined therein to the population of 1951 and the estimated population and births of ensuing years. (See Charts 2, 3, 4 and 5 of this brief.)

BIRTHRATE:

The birthrate in Alberta has been generally higher than that of Canada as a whole over the period 1931 to 1953. In recent years it has also been higher than that of most other provinces. The low point occurred in 1938 when the rate was 20.3 births per one thousand population and the high occurred in 1953 when it was 31.3. For the purposes of the projection it was assumed that the birthrate will even off at about 29 births per thousand for the last 15 years of the projection (and will have dropped back to 27 and 28 per thousand for the decade 1961 to 1970).

Reference: Vital Statistics 1953, Tables 8-17.

DEATHRATE:

The deathrate in Canada as a whole has been falling steadily since 1921. The 1921 rate was 11.6 per thousand; the 1953 rate 8.6 per thousand. The Alberta deathrate reached a peak of 9.1 in 1929, but over the period 1921 to 1953 it fell from 8.4 per thousand to 7.6 per thousand. It will be noted that both sets of figures are substantially below those of the Canada-wide average.

Many factors have a bearing on a falling deathrate, notably advances in medical care—especially of the new born—in feeding habits, in nutrition, etc. However, as deathrates are computed on the basis of number of deaths per one thousand of total population, much of the apparent decrease in the rate in recent years is attributable to the high number of births which have occurred since 1946. If there is a decline in birthrate over the next few years and other factors remain constant, the deathrate will tend to rise again, and for the purposes of this brief we have assumed that it will approach the average Canadian rate which is, in round figures, 9 per thousand.

Reference: Vital Statistics 1953, Tables 18-27.

NATURAL INCREASE RATE:

As was to be expected from the fact that the birthrates in Alberta have been above the Canadian average and the deathrates lower than the Canadian average, the rate of natural increase in Alberta has been very favourable compared with the country as a whole. The low point was 12.4 per thousand in 1936 and 1937; the high point 23.7 in 1953. The mean rate over the period 1906-1953 was 16.6. As will be seen from Table 2, the rate of natural increase is expected to recede to about 18 and 19 per thousand for the decade 1960 to 1970 and to increase again to about 20 per thousand for the last 15 years of the period under study.

Reference: Vital Statistics 1953, Table 5.

MARRIAGE-RATE:

Marriage rates in Alberta have been consistently above the Canada wide average since 1921. With but very few exceptions they have been higher in Alberta than in any other province for any given year. The average marriage rate per thousand population—Canada 1921 to 1939—was 7.2; for the period 1940 to 1953 it was 9.7. The average marriage rate per thousand population—Alberta 1921 to 1939—was 7.8; and for the period 1940 to 1953 was 10.3. In the depression decade 1931 to 1940, the Alberta marriage rate remained higher than that of other provinces. There is no apparent reason why the rate of family formation should not continue high for the next few years though it may tend to decrease towards the average Canadian rate.

Reference: Vital Statistics 1953, Table 39.

MARRIAGE AGE:

The average age of brides in Alberta remained constant over the period 1921 to 1953. Over most of the period it has fluctuated between 24.5 and 25.1 years of age. It does not differ significantly from the Canada wide average which has maintained a similar narrow range. The age range rose during the war years 1941 to 1945 when it may be assumed that it was not so easy for the brides and grooms to arrange convenient dates of marriage.

The tendency throughout the whole period has been for the average age of bridegrooms to become lower. In Alberta the average age of marriage of bridegrooms in 1921 was 30.6; in 1953, 27.8; the Canada wide average dropped from 29.9 to 28.2 in the same period.

Reference: Vital Statistics 1953, Tables 40 and 41.

FAMILY SIZE:

The table following shows the average size of family—Canada and Alberta—1941 and 1951—with a breakdown into urban and rural.

AVERAGE SIZE OF FAMILY—CANADA AND ALBERTA, 1941 and 1951

Average Number of Persons Per Family			
Canada			
	1941	1951	
Rural	4.3	4.1	
Urban	3.7	3.5	
All	3.9	3.7	
Alberta			
Rural	4.2	4.0	
Urban	3.5	3.3	
All	3.9	3.7	

Source: Census of Canada, Vol. III, Table 128 and earlier censuses.

Inspection of the table might lead to the conclusion that the size of the average family in Canada is decreasing. However, there are factors which should be taken into consideration—in particular the number of marriages and the dates when marriage rates substantially rose. The number of marriages in Alberta and Canada 1938-53 are shown in the following table:

NUMBER OF MARRIAGES					
	Canada	Alberta		Canada	Alberta
1938	90,000	7,000	1946	137,000	9,500
1939	106,000	7,800	1947	130,000	8,800
1940	126,000	8,800	1948	126,000	8,800
1941	125,000	8,500	1949	124,000	9,000
1942	131,000	9,000	1950	125,000	9,300
1943	114,000	7,800	1951	128,000	9,300
1944	104,000	7,300	1952	128,000	9,500
1945	111,000	7,300	1953	131,000	10,100

The period covers the war years in which the opportunity for conceiving children was not nearly as great as the figures on marriages might lead one to assume.

In 1946 and 1947 (as in 1939 and 1940) there was again a sharp rise in the number of marriages in Canada to 137,000 and 130,000, and in Alberta to 9,500 and 8,800. The sharp rise in the absolute number of marriages and in the rate of marriage with such a short time interval before the 1951 Census excluded the possibility of having the size of families which Canadians as a whole and Albertans in particular may have desired. The common assumption that the size of families is decreasing should not be agreed to too readily. The period in which the evidence was collected was so short that physical factors made it impossible for the definite trend to be established.

Reference: Census of Canada 1951 and Vital Statistics 1953, Tables 39-41.

URBANIZATION:

There has been a consistent historical trend towards urbanization in Alberta as shown in the following table:

URBAN PROPORTION OF TOTAL POPULATION ALBERTA,
1901-1951

	Alberta % Urban
1901	25.4
1911	36.8
1921	37.9
1931	38.1
1941	38.5
1946	44.1
1951	52.0
1951 (new definition)	47.9

Source: Census of Canada 1951, Vol. I, Table 13.

Judging by the way the rural population has levelled off in Alberta, it would appear that if there is to be an increase in population it will be in urban centres and this connotes increased industrialization. The question can be raised whether conditions in Alberta are favourable to industrialization. Factors such as proximity to markets, railway freight rates, the development of the St. Lawrence Seaway, accessibility of raw materials, are all bound to have a bearing.

MARRIED WOMEN IN LABOUR FORCE:

The rising percentage of females and of married women in the labour force is set forth in the table below: (Housewives; farmers' wives; those overage and underage; etc., are not considered as being in the "labour force".)

**PERCENTAGE OF TOTAL FEMALE POPULATION IN THE LABOUR FORCE,
ALBERTA, 1911 - 1951**

Year	Total Female Population	Number in Labour Force	Per cent of Total
	No.	No.	%
1911	150,503	11,923	7.9
1921	264,246	21,126	8.0
1931	331,406	33,449	10.1
1941	369,711	40,442	10.9
1946	379,333	45,632	12.0
1951	447,309	62,629	14.0

Of particular interest, since it may have some effect on birthrates is the number of married women in the labour force.

**PERCENTAGE OF MARRIED WOMEN IN THE FEMALE LABOUR FORCE,
ALBERTA, 1921 - 1951**

Year	Total Female Labour Force	Number of Married Women	Per cent of Total
	No.	No.	%
1921	21,126	2,790	13.2
1931	33,449	4,904	14.7
1941	40,442	4,649	11.5
1946	45,632	8,871	19.4
1951	62,629	21,117	33.7

Source: Census of Canada 1951, Vol. IV, Table 2 and 4, and earlier censuses.

The question is, of course, whether the proportion of married women in the labour force will remain at this high level. That young girls of say 18 to 21 get married and continue to work for 2, 3, or 4 years, may have no bearing in the long run on the size of the family for which they are planning. Alternatively if the married women are past the child bearing age the fact that they are working is immaterial to population growth.

There is always strong pressure in times of depression or labour surplus, both on the part of employers, labour unions, and on the part of fellow workers, to have married women removed from the labour force. There are no figures on the number of married women temporarily in the labour force who are there for some specific purpose, say to raise money for a TV set or a washing machine or other household appliances, and whose intention it is to work until these are paid for and then retire from the labour force.

IMMIGRATION:

The volume of immigration, emigration and interprovincial migration, will be the major determinant, excluding birthrate, affecting the population of Alberta 30 years hence.

The volume of immigration and emigration is subject to federal governmental control and policies. Immigration policies have varied widely during the last 75 years due to constantly changing world economic conditions. However, it is assumed that the selective immigration policies in vogue since the 1930's will largely obtain.

Table 1 shows actual increases in population over the previous year and natural increases as registered by the Vital Statistics Bureau for the

years in question. Net immigration took place in those years in which the actual increase exceeded natural increase, and net emigration in those years in which natural increase exceeded actual increase. Thus the period 1906 to 1921 inclusive, was a period of net immigration; from 1922 to 1926 was a period of net emigration; 1927 to 1931 was a period of net immigration; and the period 1932 to 1946 inclusive was a period of net emigration. From 1947 to 1954 inclusive, the province has been experiencing a period of net immigration.

Census of 1951—Alberta Population According to Birthplace

TOTAL	939,501	100%
Born in—		
Alberta	528,474	56.3
Other Provinces	171,011	18.2
United Kingdom	73,818	7.9
Other Commonwealth	1,139	.1
TOTAL—BRITISH BORN:	774,442	82.5
Born in—		
U. S. A.	55,504	5.9
Europe	105,361	11.2
Asia	3,748	.3
Other	446	.1
TOTAL—FOREIGN BORN	165,059	17.5
TOTAL—CANADIAN BORN	699,485	74.5
TOTAL—IMMIGRANTS	240,016	25.5

Of the 240,016 immigrants in the province in 1951 from outside Canada, 81 per cent came to Alberta before 1930 (Alberta Facts and Figures Table 204) and as residents of over 20 years, can be considered “permanent”. 14 per cent came in the period 1946 to June 1951.

Immigrant Population—Alberta, 1951 By Period of Immigration

Period of Immigration		Number in Alberta, 1951
Before	1911	74,873
	1911-20	56,735
	1921-30	62,523
	1931-40	9,650
	1941-45	2,455
	1946-51	33,780
TOTAL:		240,016

INTERPROVINCIAL MIGRATION:

The table below outlines the distribution of Alberta born population in other provinces of Canada, for the Census years 1911 to 1951:

ALBERTA POPULATION BORN IN OTHER PROVINCES OF ALBERTA						
	1951	1946	1941	1931	1921	1911
Newfoundland -----	773					
Prince Edward Island	2,007	1,815	2,066	2,353	2,458	1,846
Nova Scotia -----	6,784	5,762	5,859	7,033	7,423	5,003
New Brunswick -----	3,612	2,972	3,209	3,846	4,041	2,876
Quebec -----	12,620	10,673	11,760	14,247	14,970	10,112
Ontario -----	46,418	43,889	48,987	59,194	68,919	57,530
Manitoba -----	23,119	17,030	15,943	14,406	9,285	5,530
Saskatchewan -----	59,047	36,034	27,836	16,991	6,997	1,743
British Columbia -----	15,924	11,491	7,444	6,768	4,940	1,441
Yukon and N.W.T. ---	707	240	223*	829*	1,532*	2,343*
TOTAL -----	171,011	129,906	123,327	125,667	120,565	88,424
ACTUAL INCREASE:—						
	1911 - 1951 = 82,587					
	1921 - 1951 = 50,446					
	1931 - 1951 = 45,344					
	1941 - 1951 = 47,684					
	1946 - 1951 = 41,105					

*Including "not stated".

Sources: Census of Canada, 1951, Vol. I, Table 45, and earlier censuses.
Canada Year Book 1913—Page 79, Table 22, for 1911 Data.

The absolute number of Albertans born in other provinces of Canada of course rose rapidly from practically nil at the turn of the century to 88,000 by 1911, and 121,000 by 1921. The number rose very gradually over the next 25 years to 130,000 by 1946. There was a major jump to 171,000 in the ensuing 5 years: in other words a net immigration of 41,000 from other provinces.

Most of the interprovincial increase came from the other three western provinces with Saskatchewan supplying about two-thirds. Of the 59,000 Saskatchewan-born in Alberta in 1951, 42,000 immigrated since 1931. Of these 23,000 left Saskatchewan for Alberta in the period 1946-51.

The extent to which this heavy immigration from Saskatchewan will continue is a matter of reasonable doubt. It was undoubtedly accelerated by the construction boom in Alberta which in turn was engendered by the development of Alberta oil resources and petro-chemical industries. Whether discovery of oil and gas resources in Saskatchewan will suffice to stem the tide of emigration from the province can only be a matter of conjecture. The point is that while increases of British Columbia born and Manitoba born people in Alberta have been gradual and "normal" the increase from Saskatchewan is apparently most abnormal.

Saskatchewan-born residents in Alberta at Census dates increased as follows:

Over period	1946 - 51 by 23,013
	1941 - 46 by 8,198
	1931 - 41 by 10,845
	1921 - 31 by 9,994
	1911 - 21 by 5,254
TOTAL	57,304

ALBERTA-BORN POPULATION IN OTHER PROVINCES OF CANADA

	1951	1946	1941	1931	1921	1911
Newfoundland	106	—	—	—	—	—
Prince Edward Island	215	—	102	66	22	10
Nova Scotia	1,205	—	716	273	204	37
New Brunswick	449	—	262	168	112	24
Quebec	3,351	—	2,237	982	399	96
Ontario	19,017	—	10,875	4,741	2,074	549
Manitoba	5,649	4,246	3,663	2,463	1,500	491
Saskatchewan	10,631	8,893	7,781	7,403	3,431	908
British Columbia	78,305	—	38,331	20,231	9,326	2,604
Yukon	962	—	140	25	9	7
North West Territories	1,230	—	536	122	40	34
TOTAL	121,120	(N/A)	64,643	36,474	17,117	4,760
Increase over previous Census Figures	56,477	(N/A)	28,169	19,457	12,257	

Total Absolute increase in period:

1911 - 1951 was 116,360

1921 - 1951 was 104,003

1931 - 1951 was 84,646

1941 - 1951 was 56,477

Sources: Census of Canada, 1951, Vol. I, Table 45, and earlier censuses.

Canada Year Book, 1913, Page 79, Table 22 for 1911 data.

The absolute number of Alberta-born in other provinces of Canada increased from a low of 4,800 in 1911 to 121,000 in 1951, an absolute increase of 116,000 over the period.

In the decade 1941 to 1951 which included the very prosperous period 1946 to 1951 and the beginning of the oil boom, Alberta lost to other provinces of Canada over 56,000 while gaining only 48,000.

There were 40,000 more Alberta-born in British Columbia in 1951 than in 1941. It is too soon to establish definitely that this may be taken as an indication that older Albertans have a tendency to go to British Columbia to retire.

Of the 56,000, Ontario gained 8,000, and it is likely that economic opportunities available were probably drawing factors there.

It would appear from the historical record therefore, that it is difficult for Alberta to gain more by interprovincial migration than the province loses. While the picture as it emerged after 40 years is not too unfavourable to the province it must be remembered that the post-war construction boom and oil boom in Alberta which drew so many people in so short a period from Saskatchewan, did much to make the situation as favourable as it is.

The Census of 1906 ascertained that there were 38,499 Albertans born in the province. In the period 1905 - 1950 inclusive there were 696,700 born in Alberta. Or to speak in round figures and include the period to 1 June 1951, there are 738,000 Alberta-born to account for.

(1) The Census of 1 June 1951 ascertained that of these, 529,000 or 72 per cent were still resident in Alberta, and 121,000 in other provinces.

(2) 55,000 (54,774) of the 738,000 died in Alberta over the period 1921-1951, and 3,991 Albertans died in other parts of Canada. (Accurate figures on deaths by province of birth, are available only back to 1921.)

Allowing for a certain number of deaths between 1905 and 1921, it is apparent therefore that of the 738,000 born in the province, 80 per cent at a minimum, remained in the province(alive or dead).

(3) The 1951 Census ascertained that there were 650,000 of the 738,000 still resident in Canada (88 per cent).

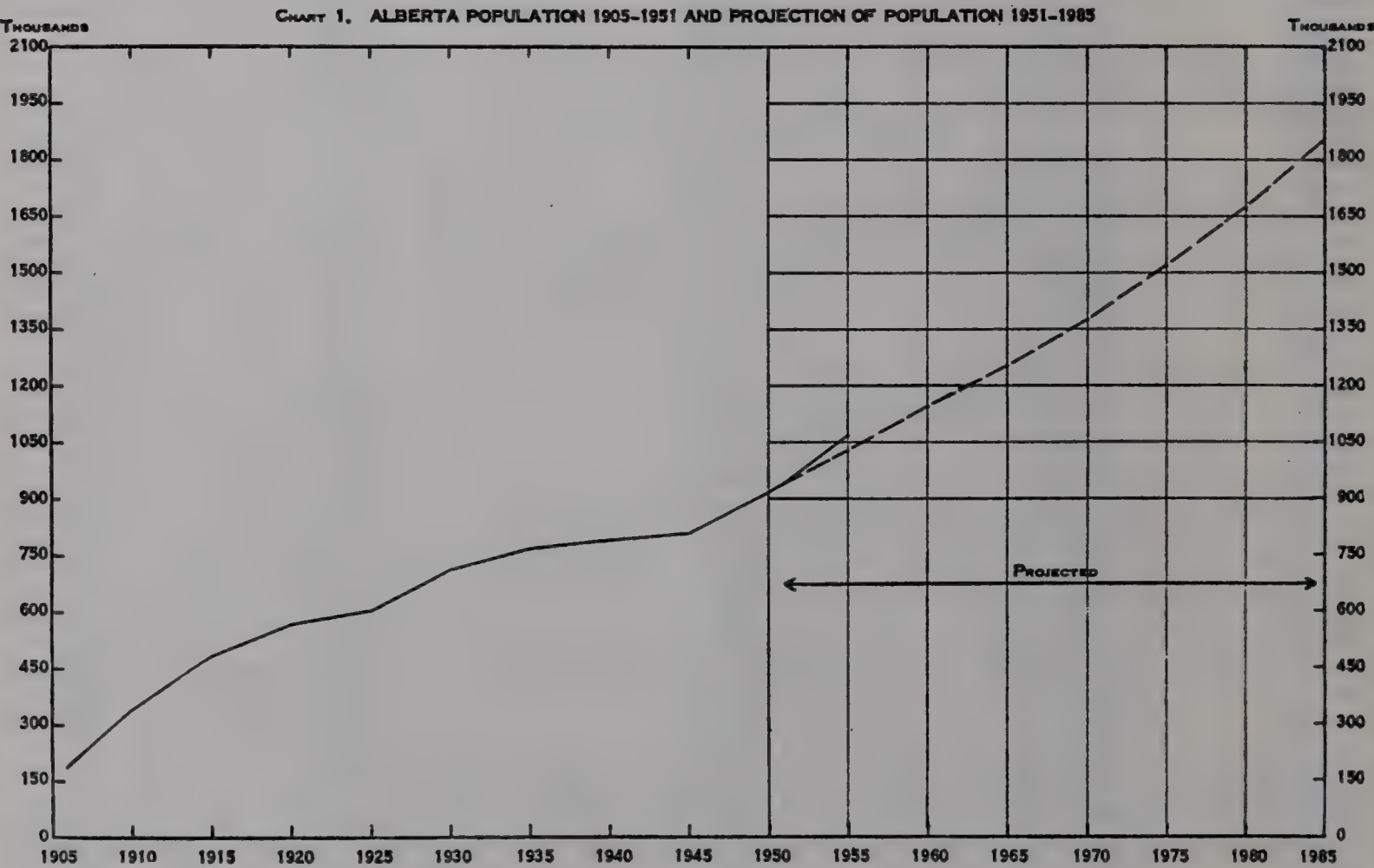
Census of Canada 1951, Vol. II, Table 10-1.

Table 1. POPULATION AND NATURAL INCREASE—ALBERTA, 1905 - 1955

Year	Population (estimated for intercensal years)	Actual Increase over Previous year	Period of	Natural Increase	Rate Rate of Natural Increase %
1906	185,000			1,912	1.3
1907	236,000	51,000		3,154	1.3
1908	266,000	30,000		3,785	1.4
1909	301,000	35,000		4,235	1.4
1910	336,000	35,000		4,795	1.4
1911	374,000	38,000		5,195	1.4
1912	400,000	26,000		6,052	1.5
1913	429,000	29,000		7,439	1.7
1914	459,000	30,000	Net	9,268	2.0
1915	480,000	21,000	Immi-	9,864	2.1
1916	496,000	16,000	gration	9,273	1.9
1917	508,000	12,000		9,529	1.9
1918	522,000	14,000		6,966	1.3
1919	541,000	19,000		8,623	1.6
1920	565,000	24,000		10,890	1.9
1921	588,000	23,000		11,621	2.0
1922	592,000	4,000		10,899	1.8
1923	593,000	1,000	Net	10,054	1.7
1924	597,000	4,000	Emigra-	9,739	1.6
1925	602,000	5,000	tion	10,227	1.7
1926	608,000	6,000		9,297	1.5
1927	633,000	25,000		9,838	1.6
1928	658,000	25,000	Net	9,993	1.5
1929	684,000	26,000	Immi-	10,685	1.6
1930	708,000	24,000	gration	12,153	1.7
1931	732,000	24,000		11,950	1.6
1932	740,000	8,000		11,469	1.5
1933	750,000	10,000		10,777	1.4
1934	758,000	8,000		10,899	1.4
1935	765,000	7,000		10,454	1.4
1936	773,000	8,000	Net	9,639	1.2
1937	776,000	3,000	Emigra-	9,642	1.2
1938	781,000	5,000	tion	10,020	1.3
1939	786,000	5,000		10,681	1.4
1940	790,000	4,000		11,156	1.4
1941	796,000	6,000		10,923	1.4
1942	776,000	-20,000		12,226	1.6
1943	785,000	9,000		12,766	1.6
1944	808,000	23,000		13,052	1.6
1945	808,000	—		13,485	1.7
1946	803,000	- 5,000		15,583	1.9
1947	825,000	22,000		18,088	2.2
1948	854,000	29,000		17,088	2.0
1949	885,000	31,000		17,852	2.0
1950	913,000	28,000	Net	18,769	2.1
1951	939,000	26,000	Immi-	19,836	2.1
1952	970,000	31,000	gration	21,760	2.2
1952	1,002,000	32,000		23,539	2.3
1954	1,039,000	37,000		26,384	2.5
1955	1,066,000	27,000			

Table 2. POPULATION PROJECTION—ALBERTA 1960 - 1985
(1951 Base Year and Population 939,501)

Year	Birth Rate (per 1,000)	Death Rate (per 1,000)	Natural Increase (per 1,000)	Population (Estimated)
1960	29	8	21	1,143,000
1965	27	9	18	1,253,000
1970	28	9	19	1,376,000
1975	29	9	20	1,517,000
1980	29	9	20	1,675,000
1985	29	9	20	1,850,000



AGE GROUPS

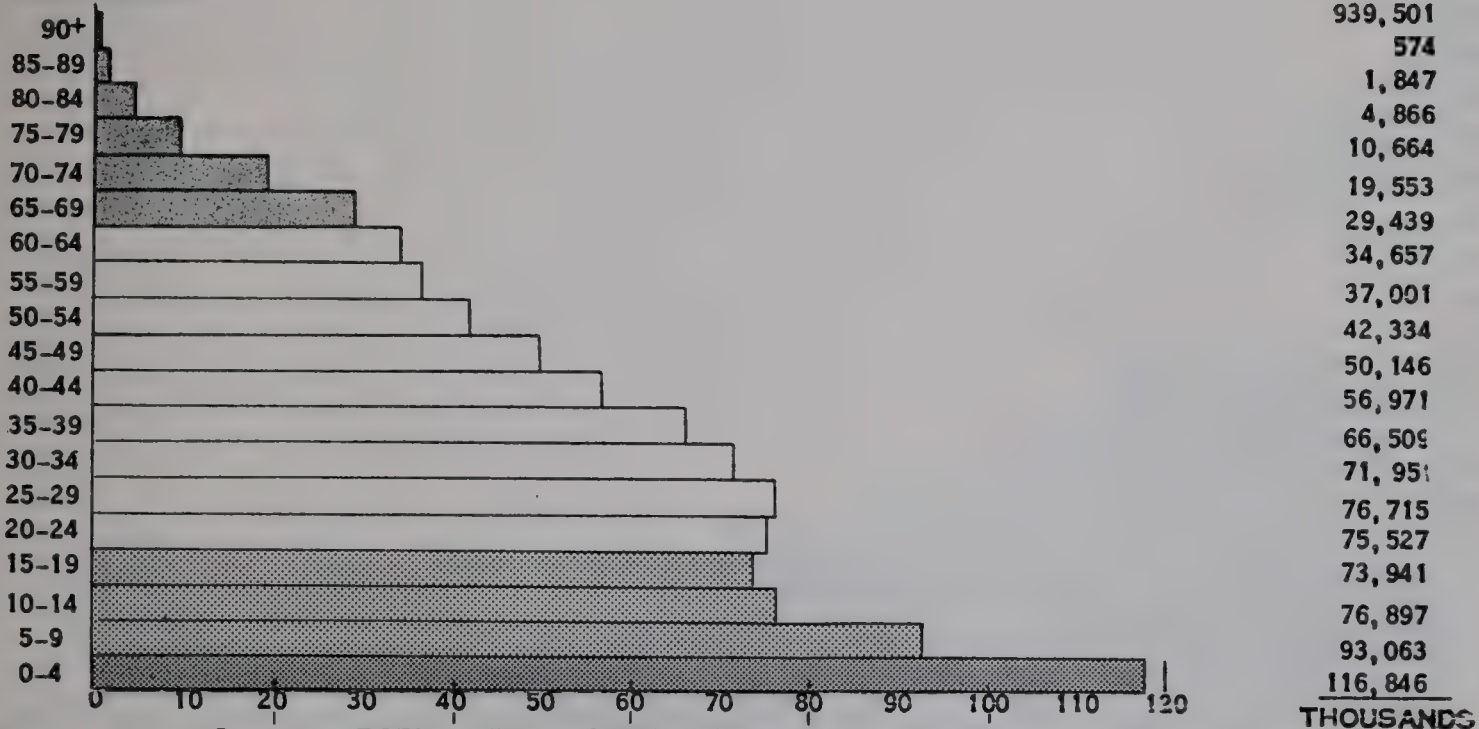


CHART 2. POPULATION DISTRIBUTION BY AGE GROUPS, ALBERTA - 1951

AGE GROUPS

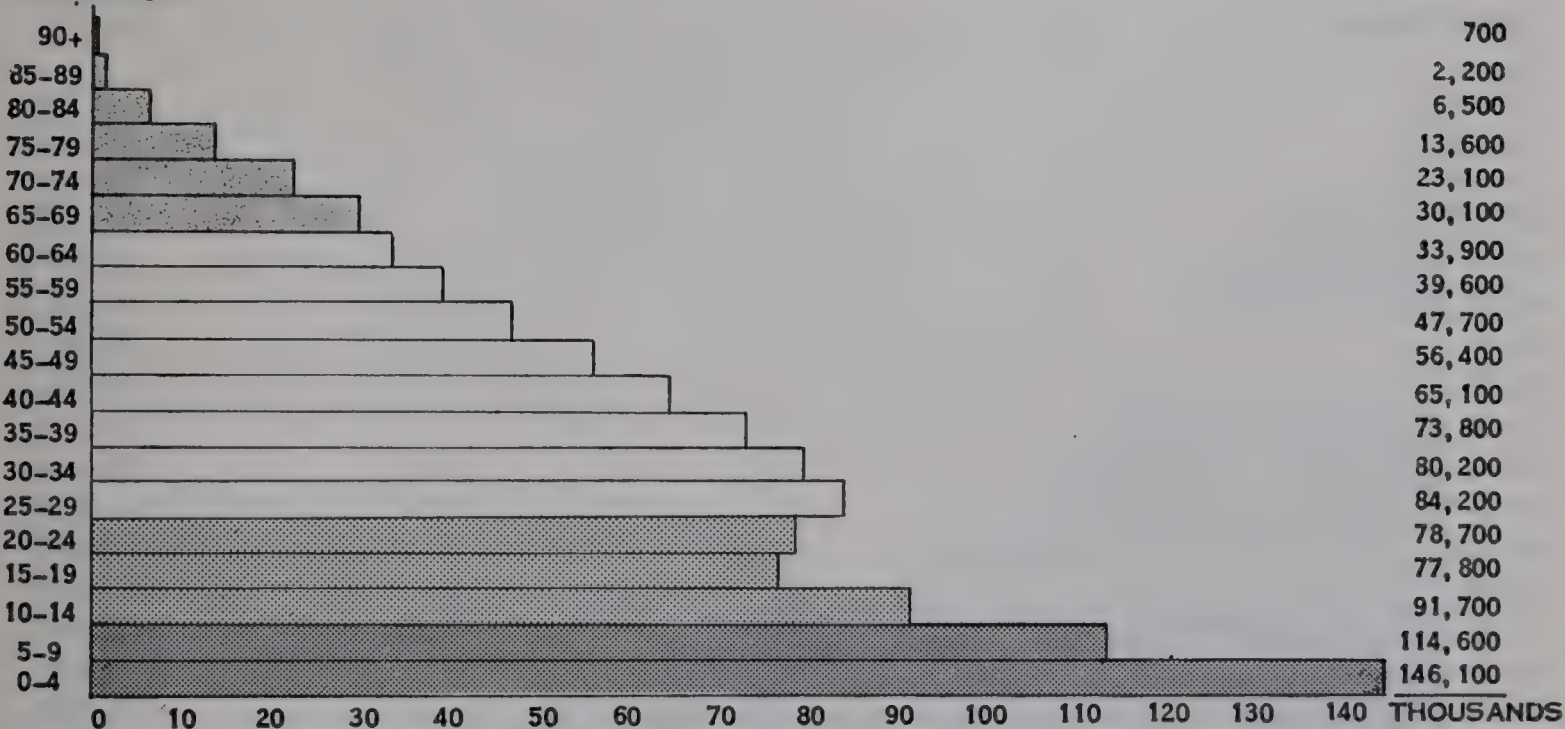


CHART 3. POPULATION DISTRIBUTION BY AGE GROUPS, ALBERTA - 1955

AGE GROUPS

1,517,000

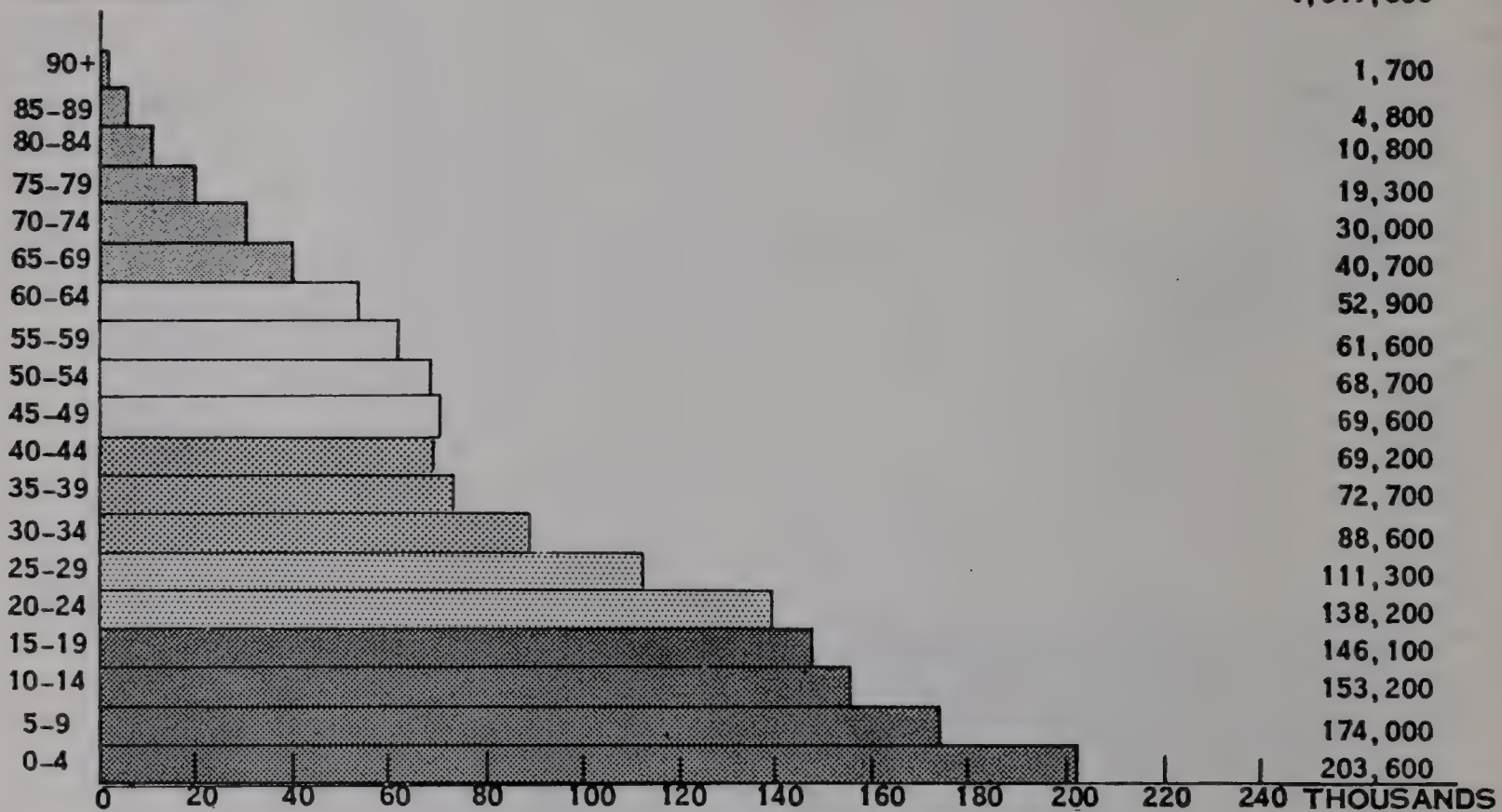


CHART 4. POPULATION DISTRIBUTION BY AGE GROUPS, ALBERTA - 1975

AGE GROUPS

1,850,000

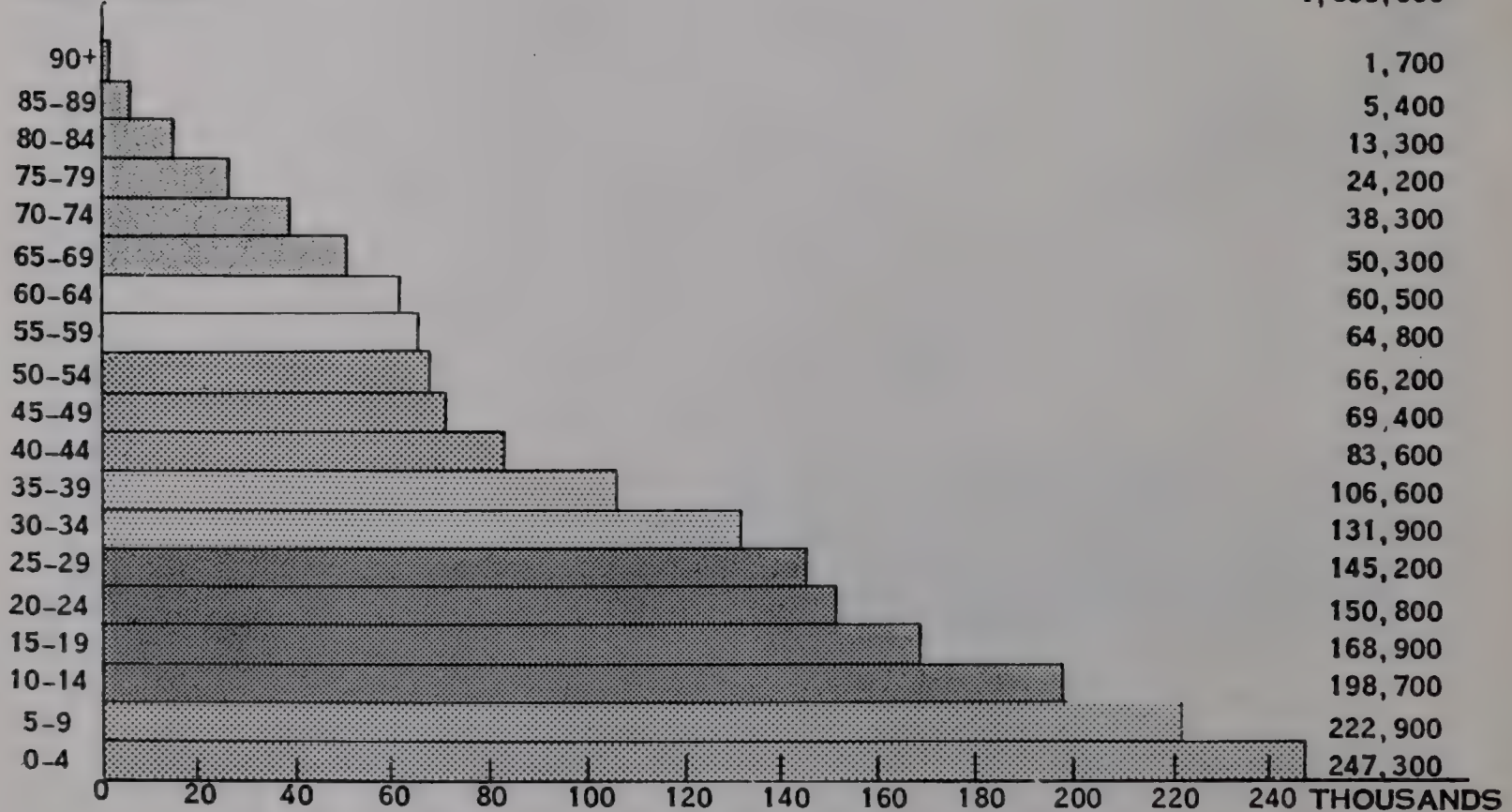


CHART 5. POPULATION DISTRIBUTION BY AGE GROUPS, ALBERTA - 1985

ALBERTA'S ECONOMIC PROSPECTS

II A. AGRICULTURE

Prepared by

Alberta Department of Agriculture

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Agricultural Statistician

DEPARTMENT OF AGRICULTURE

HONOURABLE L. C. HALMRAST,
Minister

R. M. PUTNAM,
Deputy Minister

December, 1955.

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Royal Commission on Canada's Economic Prospects

Agriculture

SUMMARY

1. This submission will deal mainly with farm resource development in the next quarter century.

2. The physical volume of agricultural production in Alberta is increasing but the percentage contributed by agriculture to the total commodity production is decreasing.

3. Alberta's potential farm land resources total 68 million acres, 30 million being fair to good arable and 10 million poor to fair arable.

4. There were 44.5 million acres of land in occupied farms in 1951. We estimate that there will be an increase of 3.2 million acres or a total of 47.7 million acres occupied in 1980.

5. Estimated increases in area improved by soil zones between 1951 and 1980, in millions of acres, (with estimated area improved in 1951 and 1980 in brackets) are: brown soils, no increase (3.5) (3.5); dark brown soils, 1.1 (8.0) (9.1); black soils, 0.5 (7.1) (7.6); grey wooded soils, 2.0 (3.7) (5.7); total, 3.6 (22.3) (25.9).

6. Irrigation canal systems now constructed make water available to 847,000 acres of irrigable land. An estimated 760,000 acres are ready to receive water. A total of 1,923,000 acres may one day be irrigated in organized districts plus some 75,000 acres through privately owned ditches.

7. The principal limiting factor in the utilization of land in irrigation areas is the market for crops that permit intensive land use. The market for sugar and processed vegetables will expand with population increases. However, for many years the bulk of our irrigated land resources may of necessity be devoted to the raising and, more particularly, the finishing of live stock.

8. Our brown and dark brown soils are pre-eminently adapted for wheat production. The percentage of cultivated land now devoted to wheat in this area is not likely to change significantly in the next 25 years. The present downward trend in the area seeded to wheat in the black and grey wooded soils area is likely to continue.

9. Increases in the acreage seeded to coarse grains will be confined largely to our black and grey wooded soils and will be associated with a more intensive use of land, more live stock on farms, the greater use of crop rotations, reductions in the areas in summerfallow and wheat, and increases in the use of commercial fertilizers.

10. Examples of changes in farm practice that might effect the development of agriculture in the future are variations in the practice of summerfallowing and the use of commercial fertilizers.

11. A significant contribution to live stock production in Alberta could be made through the further development of our grazing resources.

12. In 1954, Alberta exported a high proportion of her live stock production. The estimated percentages of the principal meats produced over and above Alberta requirements were: beef, 76.7 per cent; veal, 47.6 per cent; mutton and lamb, 41.9 per cent; and pork, 77.4 per cent.

In view of estimated increased requirements of Canadian and United States markets for red meats by 1980, Alberta might reasonably be expected to increase production of beef and veal by 75 per cent and hog production by 100 per cent over the 1954 output.

An increase in sheep production is forecast but owing to uncertainties within the industry, a quantitative forecast is not possible at this time.

13. Unless drastic unforeseen changes occur Alberta's total dairy production in terms of milk will increase from 1.39 billion pounds in 1954 to about 2 billion pounds in 1980, an increase of 44 per cent.

14. Specialization in all phases of poultry production is developing accompanied by improvements in the marketing, processing and merchandizing of poultry produce. The poultry industry in Alberta is developing at a greater rate than is the case for Canada as a whole. This trend may be expected to continue throughout the forecast period.

15. Beekeeping may be expected to expand by more than 100 per cent during the next 25 years. The need for bees as pollinating agents in legume seed production will receive greater recognition.

16. Farm mechanization in the last 50 years has been based on the exploitation of small gasoline power units. Improvements and new combinations in the application of the mechanical principles involved continue to be made.

No radically new changes are anticipated in the development of farm mechanization in the forecast period.

17. Farm building design will change considerably in the next quarter century. Buildings will be adapted along functional lines and construction design will be such as to take advantage of mechanical equipment.

Submission in Relation to the Terms of Reference

The terms of reference to the Commission on the long-term economic prospects of Canada would, in part, seem to direct inquiry into (a) the possible development and use of our farm resources and (b) prospective domestic and external markets for agricultural products of Canadian origin.

This submission will deal mainly with Alberta's farm resources and their development. Of course we cannot ignore the market altogether. For the purpose of determining the allocation of agricultural resources, it will be necessary to provide some kind of an estimate of the market for certain Canadian farm products, at home and abroad, in the next quarter century.

We shall assume that, within the next twenty or thirty years, (a) no major economic depression will occur; (b) Canadian and world population increases will be reduced from the abnormally high rate indicated since the war; (c) present nutritional standards, including the consumption of "protective" foods, will be at least maintained; and (d) that fluctuations in the demand and supply of specific agricultural products will continue to require periodic adjustments in the production programs of individual producers.

Technological improvements will affect agriculture both directly and indirectly in the future. However, no attempt will be made to forecast the possible results of crop and live stock breeding programs; improvement in the design and operation of farm equipment and machinery; better farm

planning; improved management and cultural practices; or the effects of government policies in relation to agriculture.

However, reference may be made to current trends in technological development where it appears that problems requiring specific attention are indicated.

The Position of Agriculture In Alberta's Economy

In 1951, there were 84,315 farms in Alberta, the average size being 527.3 acres. A total of 345,222 persons or 36.7 per cent of our population was living on farms.

According to census figures farm investment in 1951 totalled \$1,790 million, distributed as follows: land and buildings, \$1,015 million; live stock and poultry, \$385 million; and, implements and machinery, \$390 million.

For the years 1950 to 1954 inclusive gross farm income, operating expenses and depreciation, and net income of farm operators from farming operations are shown in Table 1.

TABLE 1.

Year	Gross Farm Income	Operation Expenses and Depreciation	Net Farm Income
— thousands of dollars —			
1950	437,424	205,182	232,242
1951	626,383	233,969	392,414
1952	617,560	257,711	359,849
1953	554,336	253,563	300,773
1954	419,132	242,095	177,037
Average	530,967	238,504	292,463

High operating expenses are associated with the commercialization of agriculture. In the period 1950 to 1954, 45 per cent of gross farm income was required to meet operating expenses. By the same token, expanding needs of farmers for machinery, equipment, fertilizer and other materials will influence the development of manufacturing industries.

Chart 1 shows the net value of commodity production in Alberta by industries for the period 1920 to 1952 inclusive. The contribution toward total production made through agriculture was 47 per cent for the years 1950 to 1952 inclusive compared to an average of 68 per cent in the 1920's. This decrease in the relative importance of agriculture occurred, in spite of the fact that the volume of physical goods produced by farmers increased (see Chart 2).

Farm Land Resources

Alberta's potential farm land resources have been estimated at 68 million acres. About 30 million acres are considered fair to good arable land and 10 million are rated as poor to fair arable. A high proportion of the remaining 28 million acres may be improved for pasture or meadow by brushing, draining, or seeding to tame grasses and legumes.

According to the 1951 census, there were approximately 44.5 million acres of land in occupied farms in Alberta. A total of 22.3 million acres of improved land was utilized as follows: in crops, 14.4 million acres; pasture, 1.1 million; summerfallow, 6.2 million; and 0.6 million were in "other uses".

A high proportion of the 22.2 million acres of unimproved farm land was natural pasture.

The possibilities of farm land development in Alberta may be divided into three parts; namely, (a) new settlement, (b) the development of occupied prairie and woodland still in a natural state, and (c) the more intensive use of land already improved.

Land Settlement, Past and Future

Most of the readily accessible homestead land in Alberta was occupied prior to the first world war; but the settlement of prairie and lightly-wooded land in northern and Peace River areas, continued until the mid-twenties. Between the conclusion of the first world war and 1930, a high proportion of the unoccupied railway and school lands and unimproved land held by speculators, was absorbed into established farms through purchase or lease. By the time the unalienated natural resources were transferred to the province in 1930, new settlement could be accommodated only on lands that were definitely marginal because of fertility or location.

Nevertheless, between 1931 and 1951 the area of occupied farm land in Alberta increased from about 39.0 to 44.5 million acres (see Chart 3). An analysis of the location of land acquired in this period shows that more than 50 per cent of the total was located in long-settled districts (see Chart 4). For example, 3 million acres were appropriated for farming in census divisions 1 to 8, 10 and 11. Only 2.5 million acres were added in the divisions —9 and 12 to 17—which contain a high proportion of the fringe areas.

New lands for future settlement, however, are situated almost entirely in our fringe areas on the north and west. The soils involved are mostly grey wooded and tree cover varies from light to heavy.

With modern equipment the clearing and breaking of land can be accomplished easily and quickly. But the costs involved are considerable. On a custom basis, charges for clearing vary from \$10 to \$25 an acre and breaking costs range from \$8 to \$12 an acre.

Other factors tend to deter new settlement on grey wooded soils. Their natural fertility is relatively low and they cannot be exploited quickly as prairie soils were. The development of grey wooded soils as hay, live stock and grain producing units is a relatively slow process under homesteading conditions. Indeed, the toughness of this problem is indicated by the fact that progress made in the utilization of these soils to date is on the whole somewhat short of gratifying.

Nevertheless, moderate gains in the acquisition of new land for farming may be expected to continue during the next twenty or thirty years. This view is based on the following considerations:

(a) There remains a considerable amount of public land open for homestead application in the grey wooded soils area.

(b) Many persons who wish to farm have not the means to acquire an established enterprise, but are willing to undertake the task of developing a homestead.

(c) Current and prospective developments in the north, including the construction of trunk highways and roads built to facilitate the search for petroleum will provide access to new districts.

(d) Established settlements in outlying districts will tend to expand to include suitable land lying adjacent to the lands occupied.

In 1951 there were 44.5 million acres of land in occupied farms in

Alberta. We estimate that 34.5 million acres were situated in the brown, dark brown and black soil zones and that 10 million acres were in the grey wooded soils zone.

We estimate that the occupied land in the grey wooded zone has increased in recent years as follows: 1931, 6.4 million acres; 1941, 7.8 million acres; and 1951, 10.0 million acres. On the basis of these estimates, the average annual increase in the acquisition of land for farming was 180,000 acres.

At the same rate of increase an additional 5.4 million acres will be converted to farm land by 1980. In our opinion, however, the acquisition of new land for farming will be much reduced in future as compared to the last twenty-five years. We estimate that a further 2.7 million acres may be added to farms in the grey wooded soils zone by 1980.

The area of unoccupied land in the brown, dark brown and black soil zones is probably confined entirely to land which is submarginal for arable use. It will be acquired largely for grazing purposes. We may venture to suggest that 1.5 million of an estimated 3.5 to 4 million acres of such land available will be alienated within twenty-five years.

Our total estimate, therefore, is that 3.2 million acres of new land may be appropriated for farming. This would increase the total area in farms from 44.5 to 47.7 million acres.

The Development of Occupied Farm Land

Between 1911 and 1931 the development of farm land was rapid. In the following 20 years the area improved annually levelled off, (see Chart 3) increasing from 17.8 million acres in 1931 to 22.3 million in 1951, an increase of 25 per cent.

Chart 5 shows a comparison of land improvement in the latter period by census divisions. Most of the development took place in the extreme south-east, west central and northern areas. As a result of adjustments following the oversettlement of marginal lands in east central districts (Hanna to Wainwright) the area improved in this region decreased.

In the past, most of the land improved was intended for the production of annual crops, principally grain. In the next quarter century, it is anticipated that considerable land to be utilized as permanent pasture will be improved. In this section, however, reference will be made to the improvement of arable land only.

Estimates of total arable land, the area improved up to 1951 and the area that might be improved between 1951 and 1980 are shown by soil zones in Table 2.

LAND CLASS	TABLE 2. SOIL ZONES				
	Brown Soils	Dark Brown Soils	Black Soils	Grey Wooded Soils	Total
	— thousands of acres —				
Total Area	12,500	16,000	10,000	30,000*	68,500
Total Arable	6,000	10,500	7,600	14,000	38,100
Fair to Good Arable	2,000	9,000	7,500	—	—
Poor to Fair Arable	4,000	1,500	100	—	—
Area Improved 1951	3,500	8,000	7,100	3,700	22,300
Forecast					
Improved 1951-1980	—	1,100	500	2,000**	3,600
Total Improved 1980	3,500	9,100	7,600	5,700	25,900
Percentage Increase					
Forecast	—	14	7	54	16

*Settled or available for settlement.

**Reduced from 2,800,000. See text.

Brown Soils: We conclude that with 3.5 million acres improved, the area utilized for crop production in the brown soils zone has probably reached a practical limit, except insofar as affected by the extension of irrigation which may tend to change land use rather than increase the area cultivated. Considerable land now cultivated is rated below fair in quality. Moreover, intercensal fluctuations in the area improved would indicate instability in land use at the margins. The final result, in our opinion, is that the area in arable use in this soils zone may be reduced from what it is now.

Dark Brown Soils: In 1951, an estimated 8.0 million acres of land in the dark brown soils zone were improved. It follows that about one million acres of fair to good arable land remained in an unimproved state.

We estimate that the rate of increase in land improvement, on an acreage basis between 1931 and 1951, will continue until at least the fair to good arable land is under cultivation. On this basis 1.1 million acres of new land will be improved between 1951 and 1980. This will exhaust the fair to good land available and will increase the total improved area to 9.1 million acres.

Black Soils: Some 7.1 million acres of land were improved in the black soils zone in 1951. We conclude that practically all the land that may be classed as fair to good is now improved (1955). Certainly there will not be any remaining at the end of our forecast period. The total area under cultivation in the black soils zone in 1980 is estimated at 7.6 million acres.

Grey Wooded Soils: An estimate of future possible developments in the grey wooded soils zone is subject to greater error than is the case in the more easily developed prairie regions. Settlement has been scattered throughout the main areas of the wooded soils for many years but only a small part of the total potential farm land has been developed.

In view of the difficulties involved, it is our opinion that land settlement in the wooded soils area will be limited in future. Increases in the improved area will depend upon the expansion of farm operations on the part of existing operators and, perhaps in lesser degree, to growth in the farming communities now established.

The estimated acreage improved in the wooded soils zone by decades were: 1931, 1.8 million; 1941, 2.8 million; and 1951, 3.7 million. By projecting the average annual acreage increase for either the periods 1931 to 1951 or 1941 to 1951, the calculated total acreage improved in the period 1951 to 1980 would be 2.8 million. We suggest, however, that this rate of land improvement will not continue. An increase of 2.0 million acres with a total of 5.7 million acres of improved farm land on grey wooded soils in 1980 would appear to be a sufficiently optimistic estimate.

Summary: We estimate that between 1951 and 1980, 3.6 million acres of new land will be improved in Alberta or 16 per cent over the 22.3 million acres reported in the 1951 census. On the basis of this estimate, improved farm land will total 25.9 million acres at the end of the forecast period.

Irrigation

Irrigation canal systems in Alberta make water available to 847,000 acres of irrigable land of which an estimated 760,000 acres have been made ready to receive it.

Our potential irrigable area is estimated at 2 million acres including privately-owned projects. According to one estimate, irrigation canals will be constructed to serve the whole area within 25 years. This accomplishment

would undoubtedly result in acute settlement and land-use problems. In our opinion, the expenditure of public funds in the further development of irrigation, should not be undertaken without due consideration being given to the development of lands presently under the ditch.

According to the census, 4,044 farmers reported a total irrigable area of 564,000 acres or about 140 acres per farm, in 1950. Assuming that the average area irrigated per farm remains the same, in the neighbourhood of 6,000 farms may be developed on the irrigable land now available. More farms will result if the production of intensive crops becomes relatively more important than they are now.

Spence, Kristjansen and Anderson of the Marketing Service, Economics Division, Canada Department of Agriculture, writing of a study conducted in 1940 and 1941 stated:

For the most part the land-use pattern in the irrigated areas of Alberta is remarkably uniform. Even the farms having the most intensive cultivation had the bulk of the cultivated acreage seeded to cereal crops, most of it being in wheat. . . .

. . . the Canada Land-Bow Slope-New West area contains the farms having the largest number of acres per farm as well as the largest number of acres under cultivation. The Brooks-Rosemary area does not differ significantly from the area mentioned in the foregoing in land use, the only difference being that the latter devotes a larger acreage to peas and other more specialized crops. The United Irrigation District is similar in its land use although there is a somewhat stronger tendency to mixed farming. The Taber-Coaldale area, on the other hand, constitutes a significant variation in that sugar beets and other intensive crops occupy a considerable acreage. This probably explains why the irrigated acreage per farm in this area is less than in any other.

Up to the present time the development of irrigation farming in Alberta has been gradual because the use of water demands a type of agriculture of considerable intensity, particularly where costs of irrigation are high. Even in the Taber and other areas where beets are grown, the increase in the acreage of this crop has been gradual. While as a source of income, beets are by far the most important crop in the Taber District, the acreage in this crop was less than one-third of that in wheat. Much of this wheat was grown on the non-irrigated cropland. . . .

The number of livestock kept on irrigated farms studied in 1939 to 1941 varied with the type of farming. On the grain farms there were fewer livestock (of all kinds).

The type of farming practised is the most significant factor affecting income on irrigated farms. Farm incomes are closely related to the intensity of land use. Specialization in grain growing results in low gross and net incomes. Grain farming and live stock combinations are more profitable. In the Taber-Lethbridge area, the addition of specialty crops, such as sugar beets and vegetables, contributes toward the financial success of irrigation farming. In the northern and western sections of the irrigated area, alternative or additional enterprises are limited to such crops as potatoes and seed production.

A contract to grow sugar beets provides a solid foundation for success in irrigation farming. However, fewer than 1,600 farmers hold beet contracts, the average area per farm being about 24 acres. The production of canning crops is more hazardous and is undertaken, for the most part, in conjunction with beet growing. A combination of sugar beets and canning crops, (a) associates a "sure" crop with a hazardous one, (b) assists in the arrangement of crop rotations, and (c) distributes farm labour requirements.

The result is that the development of the vegetable processing industry at Lethbridge and Taber, does not appear to have provided many additional farmers with an opportunity to intensify their crop production program.

The soil and water resources available in Alberta for the production of specialty crops grown on irrigated land, will exceed requirements for a

long time. The principal factor limiting these crops is generally considered to be the market, the area served being relatively thinly populated and restricted by competition from east and west largely on the basis of transportation costs.

The extent of the market for Alberta sugar is indicated by the fact that it "competes" in Winnipeg. More than one-half our production of canned vegetables is marketed in Alberta, about one-quarter in Saskatchewan and a lesser proportion in Manitoba. Some is consumed as far distant as Vancouver and Fort William. A high proportion of the frozen peas produced is presently marketed in Toronto and Montreal.

It is estimated that Alberta's population will increase by 60 per cent between 1954 and 1980. Assuming the same population increase in the trade area for Alberta sugar, the area devoted to sugar beets will increase from 37,000 to 60,000 acres annually provided average per acre yields do not change. In bringing about increased production we suggest that the acreage contracted per farm, as well as the number of growers holding contracts, will increase.

The situation in respect to the production of other vegetables is not so clear. With increasing urbanization, we can conceive that vegetable sales per capita will increase. On the other hand, the industry does not yet appear to be fully developed in relation to the potential market now available. A solution to key technological problems, could result in spectacular growth. For example, "a satisfactory canning tomato for this area could increase the overall pack by five times in a few years." Technological developments and market adjustments arising as a result of the growing practice of processing by freezing, are likely to be extensive.

Moreover, growing vegetables for processing and for the fresh trade, has not yet become well integrated into farming practice and a forecast regarding farmers' acceptance of contracts covering the growing of large acreages of vegetables would be hazardous. Undoubtedly, the industry will gain through experience at both the grower and processor levels. The introduction of new crops and the adaptation of crop varieties now grown are continuing. The recent introduction of cucumbers and dry beans (for household use and canning), and the work of the Dominion Experimental Farm Service aimed toward developing a canning tomato suited to the area are examples of the effort that is being made.

Competition, mainly from the United States, in the market for fresh vegetables has seriously effected development in the production of vegetables for the fresh trade. Pre-shipment cooling and freezing facilities now available at Lethbridge, will tend to encourage the production of perishable commodities requiring special treatment of this kind.

Thus, for the next quarter century at least, only a relatively small number of farmers on irrigated land can expect to engage in the production of intensive specialty crops. Alternatives, such as the growing of legume seed, will be developed. However, a high proportion of irrigation farmers will likely arrange combinations of farm enterprises involving the production of grain and live stock as individual circumstances permit. The ranch-feeder type of business may be chosen where dry-land range is available for raising cattle or sheep. In such cases, feed for wintering and finishing would be produced on the irrigated portion of the farm. Farmers with limited summer grazing will finish cattle or sheep marketed off ranges in the fall.

Technological advances could expand opportunities for the use of irrigated land. For example, a process for the manufacture of powdered milk

that could be reconstituted instantly might result in the production of milk on a large scale in irrigated areas.

As comparative advantages for the production of live stock increase, and we assume they will, irrigation farmers will tend to increase the relative importance of live stock in their production programs. However, increased capital requirements and the time it takes to develop competence in the management of live stock enterprises, are practical considerations that cannot be overlooked. The production of live stock on an intensive land-use basis involves a considerable degree of hazard for the inexperienced. Live stock finishing operations require financial reserves or suitable borrowing arrangements.

In conclusion, the utilization of land under irrigation in Alberta is, generally speaking, not yet sufficiently intensive to ensure maximum returns to water users. The processes of adjustment now being carried out are not likely to be completed for some time.

The Production of Principal Cereal Crops

Wheat: The prospects for wheat production in Alberta cannot be separated from the question of wheat marketing for Canada as a whole. It is pertinent to our study of the position of wheat in Alberta's future farm production program, therefore, to note that total world requirements for wheat as a bread-grain are large and relatively inelastic but, that the supply, owing to variations in yield, is highly elastic. Under the circumstances, it would seem improbable that a reasonable balance between the supply and demand for wheat will be achieved in the foreseeable future.

In 1951, 6.4 million acres of wheat were planted in Alberta, a decrease of about one-fifth from the 7.9 million grown in 1931. The proportion of improved land seeded to wheat in these years fell from 45 to 29 per cent.

In the period 1931 to 1951, wheat production was fairly well maintained on our brown and dark brown soils, decreasing from 47 to 38 per cent of the land area improved. On the other hand, the area devoted to wheat expressed as a percentage of improved land, was 41 per cent in 1931 and 19.7 per cent in 1951.

The resistance to change from wheat growing in the prairie region is positive in character. In the first place, the area is pre-eminently adapted for the production of wheat. Comparatively level land surfaces facilitate the development of mechanized operations in relation to wheat growing on a large scale. Thus, the prairie farmers' resources are invested almost entirely in the production of wheat. Involvement in heavy capital investments in a highly specialized farming enterprise is a major deterrent to change.

We have suggested that in 1980, some 12.6 million acres of arable land will be improved in the brown and dark brown soil zones. There would seem little reason to believe that the utilization of cultivated land in these zones will change much in the meantime. With a reduction in wheat acreage to 30 per cent of total improved land, the region may be expected to devote 3.8 million acres to this cereal annually. The percentage summerfallowed will probably remain unchanged for a total of 4.0 million acres. The area in coarse grains, and improved hay and pasture will likely show a considerable percentage increase and absorb the total reduction in wheat acreage.

A high proportion of the land in Alberta's black and grey wooded soil zones is suited for mixed farming. Thus a reduction in wheat acreage and increases in the area devoted to the production of feed for live stock would appear to have been inevitable. However, wartime policies designed

to increase live stock production, improved markets for live stock products and restrictions on the deliveries of wheat, combined to hasten portending land use adjustments.

The area seeded to wheat expressed as a percentage of total area improved in census divisions situated largely in the black soils zone for 1951 (with 1931 figures in brackets) were: division 8, 19 (42); division 10, 28 (50); and division 11, 10 (31). On grey wooded soils in census division 9, the proportion of improved land in wheat was 7 per cent in 1951 compared to 31 per cent in 1931. Corresponding figures for division 16 were 45 and 25 per cent for 1931 and 1951 respectively.

We estimate that the proportion of improved land in wheat on Alberta's black and grey wooded soils, decreased from 41.9 per cent in 1931 to 19.7 per cent in 1951 and to 16.0 per cent in 1954. We suggest that 12 per cent of the improved land or 1.6 million acres will be seeded to wheat on our black and grey wooded soils in 1980.

To summarize, we suggest that 5.4 million acres of land will be seeded to wheat at the end of the forecast period. Assuming an increase in average yields of 1.5 bushels an acre, the total production of wheat may be expected to be in excess of 90 million bushels in an average crop year. Detailed estimates follow:

Estimated Wheat Production in 1980

Soil Classes	Area Improved Million Acres	Improved Land Per Cent	in Wheat Million acres	Yield* Bus. per acre	Production Million bus.
Brown and Dark Brown	12.6	30.0	3.8	15.7	60.0
Black and Grey Wooded	13.3	12.0	1.6	21.7	34.7
Total	25.9	20.8**	5.4	17.5	94.7

*Average yields estimated for period 1925 to 1950 plus 1.5 bushels to offset crop and cultural improvements.

**Based on an estimated 25.9 million acres of improved land in 1980.

Coarse Grains: A high percentage of the coarse grains produced in Alberta are fed on the farms on which they originate. Estimates of apparent farm consumption over the last 10 year period indicate the increased interest that has taken place in the business of raising and finishing live stock. Increases in the apparent consumption of oats and barley fed on Alberta farms in the last five years compared to the period 1945-46 to 1949-50 were 42 and 81 per cent respectively. Details are given in the following table:

	OATS			BARLEY		
	1945-46 to 1949-50	1950-51 to 1954-55	1945-46 to 1954-55	1945-46 to 1949-50	1950-51 to 1954-55	1945-46 to 1954-55
— Million Bushels —						
On Farms August 1	24.6	20.6	22.6	11.4	17.0	14.2
Production	75.0	104.6	89.6	45.6	91.4	68.5
Total Supply	99.6	124.8	112.2	57.0	108.4	82.7
Sold Through						
Elevators	24.4	28.6	26.5	17.2	39.4	28.3
On Farms August 1	22.6	21.6	22.1	12.0	18.6	15.3
Apparent Farm Consumption	52.6	74.6	63.6	27.8	50.4	39.1

Thus, increases in the production of coarse grains in Alberta came as a result of relatively favourable opportunities for marketing grain through live stock. Nor were these opportunities limited to expansion in the production of live stock in this province. Increases in the amounts of coarse grains marketed by farmers, reflect the demand for feed in deficit producing provinces and for export. Federal government freight assistance on feed grains moving from the Prairie Provinces helped to move coarse grains into the hands of feeders in other provinces.

In the next quarter century, the live stock industry and feed grain requirements will continue to expand. We estimate that the consumption of meats and other live stock products in Canada will steadily increase. Moreover, the report of the United States Materials Policy Commission forecasts a measure of dependence on Canada for supplies of feed grains and suggests, by inference, that imports of meats and other live stock products from Canada may increase by about 50 per cent in 1975 as compared to 1950.

We estimate that the area devoted to the production of coarse grains in Alberta, will increase from the 6.4 million acres recorded in 1951 to 9.1 million acres in 1980. Most of this increase will take place on our black and grey wooded soils. Expansion in the area seeded to feed grains will be associated with more live stock on farms, the greater use of crop rotations, a reduction in the acreage in wheat and summerfallow, and increases in the use of commercial fertilizers. Higher yields per acre as a result of intensification in land use would appear to be indicated.

Measured in terms of barley, the production of coarse grains in Alberta calculated on the basis of long-time average yields, may be expected to increase from about 160 million bushels in 1951 to nearly 250 million in 1980.

Summary: The adaptation of land resources for the production of different grains pretty well determine net returns from wheat relative to feed grains. This factor will be equally effective in 1980. As a result wheat production will continue on a considerable scale on our prairie soils. The production of feed grains associated with increases in live stock production, will predominate on our black and grey wooded soils.

Estimates of present land use and its probable use in 1980, by major soil classes, are shown as follows:

Land Condition and Use	Brown and Dark Brown Soils		Black and Grey Wooded Soils		Total	
	1951	1980	1951	1980	1951	1980
Million acres						
Improved	11.5	12.6	10.8	13.3	22.3	25.9
Wheat	4.3	3.8	2.1	1.9	6.4	5.7
Coarse Grains	1.9	2.9	4.5	6.2	6.4	9.1
Summerfallow	3.9	3.6	2.3	1.8	6.2	5.4
Other	1.4	2.3	1.9	3.4	3.3	5.7

Intensive Versus Extensive Use of Land

Summerfallowing is a common and growing practice on Alberta farms. In 1951, 30 per cent of the land devoted to the production of field crops was in fallow. The extension of the practice in the north-central region of the province—census divisions 5, 6, 7 and 8—in the period 1931 to 1951, is shown in Chart 7.

Extensive experimental work has demonstrated that commercial fertilizers will increase the average yields of grain crops by the equivalent of 5 bushels of wheat to the acre. It is estimated that 2 million acres are now fertilized in Alberta each year. The resulting increase in production amounts to 10 million bushels of wheat equivalent. It has been stated that the present volume of fertilizers used will be tripled in twenty-five years. The increase in the production of grain as a consequence might be calculated as the equivalent of 30 million bushels of wheat.

Developments in the use of summerfallowing and commercial fertilizers are examples of changes in farm practices that will affect development at the margins. Measures that improve farm efficiency are usually most effective in respect to the better soil classes. Thus technological improvements developed and practiced in the future may tend to increase production on our higher grades of soils and retard the development of marginal soils. Such considerations may affect our estimates of future increases in occupied and improved farm land.

Improved Permanent Pastures

Little has been done to date in respect to the improvement of permanent pastures. However, with pressure on our grazing resources increasing significantly, a major pasture and range improvement program will almost certainly develop within the next twenty-five years.

The results of experimental work indicate the possibilities. Very briefly, it is estimated that the partial reseeding of native pastures to crested wheat grass, rotational grazing and the full utilization of cover crops could possibly double the carrying capacity of our cattle and sheep ranges. Similar opportunity for increasing pasture production on land submarginal for arable use in non-ranching regions would appear likely.

The area of permanent pasture that might eventually be improved is indicated by the fact that the census for 1951 shows a total of 19.3 million acres of unimproved land on farms exclusive of the area under tree cover. A high proportion of this area will always be utilized as permanent pasture; conceivably all of it could be improved in some degree.

Live Stock Production

The number of live stock on farms in Alberta for the period 1908 to 1955 are shown graphically in Chart 9. In recent years cattle and hogs have dominated the live stock industry. Sheep have declined relative to other classes of stock since the thirties. The horse population is shown on the chart only to indicate the decreasing feed resources required for their keep.

Alberta is a heavy exporter of live stock and live stock products. The statement following shows the estimated production of live stock in the province for 1954, and calculations indicating the approximate quantities of meat produced and the amounts consumed in Alberta and available for export:

	Beef	Veal	Mutton and Lamb	Pork
Number Head Produced ¹ _____	558,158	190,926	137,976	2,046,079
Meat Produced '000 lb. ² _____	263,562	18,443	5,898	261,080
Consumed in Alberta '000 lb. ³ _____	61,500	9,663	3,429	58,911
Available for Export '000 lb. ⁴ _____	202,062	8,780	2,469	202,169
Per Cent Available for Export _____	76.7	47.6	41.9	77.4

¹ Includes net marketing, farm slaughter and inventory change.
² The estimates of meat production shown are inexact to the extent than animals exported as feeders or representing changes in inventory, vary from the average weight of animals slaughtered.
³ Based on average consumption per capita in Canada for the period 1945-1954.
⁴ From the province.

It is estimated that Alberta's population will increase from 1,047,000 in 1954 to 1,675,000 in 1980. Should the population of Canada increase at the same rate, the quantities of meats and other live stock products required for domestic use in 1980 will not be less than 160 per cent of current consumption.

The United States Materials' Policy (Paley) Commission, estimated an increase of 48 per cent in the meat requirements of that country between 1950 and 1975. The Commission also indicated that, in 1975, total supplies of meat would come from present sources on the same percentage basis as in 1950. Therefore, since the United States provides the principal market for Canada's surplus live stock and meats, the export demand for these commodities in the forecast period might be expected to rise at a rate approximating the increase in home consumption.

Assuming a 60 per cent increase in the total demand for meats of Canadian origin in the next quarter century and, using average annual production for the last five years as a base, meat output in Canada in 1980 is shown as follows:

	Average 1950-1954	Estimate 1980
	— million pounds —	
Beef and Veal	1,075	1,720
Mutton and Lamb	32	51
Pork	984	1,574

Alberta's contribution toward providing estimated meat requirements for domestic and export markets in 1980, cannot be determined without a close examination of national farm resources in relation to the total demand for food. However, we might reasonably assume that increases in the production of live stock in this province will be above the average for Canada.

The carrying capacity of our natural pastures might be doubled by partial seeding to tame grasses plus the adoption of improved grazing practices. The possibilities for the production of "cover crops" have not yet been fully exploited. The development of more arable land, the extension of crop rotation practices and the use of fertilizers, will increase the production of both long and short feed. A considerable portion of our irrigable land will likely be developed in relation to the raising and finishing of live stock.

It would, therefore, appear reasonable to forecast that the production of beef and veal in Alberta will increase by 75 per cent between 1954 and 1980, or from about 282 to 494 million pounds annually. On this basis, the number of cattle produced will increase from 558,000 to 976,000 head and the production of calves will increase from 190,000 to 334,000 head.

According to the 1951 census, 5,327 farms in Alberta reported sheep, a reduction of 40 per cent from the 8,742 reporting sheep in 1941. However, numbers have steadily increased since the last census was taken.

The large decrease in sheep production was owing mainly to a reduction in range flocks. In census division 1, for example, sheep numbers dropped from 171,000 in 1931 to 47,000 in 1951 (see Table 8). It is the opinion of close observers that the range sheep industry may decline further. Sheep ranching is highly specialized and skilled herders are required for success. Labour shortages in recent years have tended to favour cattle ranching as an alternative.

There is a growing tendency to increase the production of sheep on farms in Alberta. Sheep utilize marginal lands to greater advantage than cattle do, and they permit more intensive land use. There are strong indications that sheep raising will be used extensively in the development of our irrigated land.

However, two key problems must be solved before our sheep-raising resources are fully utilized. The threat of predatory animals must be appreciably reduced. Secondly, we require a breed of sheep suited to farm conditions in Alberta. A docile, fast-growing breed, yielding good quality mutton and wool would aid greatly in establishing sheep raising on farms.

We suggest that sheep numbers will increase in Alberta but, since the industry is in the process of re-adjustment at the present time, the future is not clearly indicated. For this reason, we hesitate to forecast the extent of the development that might take place.

The hog is our principal grain-consuming animal, the 2 million odd head produced in Alberta last year requiring some 40 million bushels of barley or its equivalent.

Owing to our geographic position, Alberta is at a slight disadvantage in the marketing of feed grains produced. In practice, this disadvantage becomes an incentive to produce hogs.

As a means of marketing grains, Alberta farmers may be expected to maintain the production of hogs at near the margin of profitability in the immediate future. In the long run, population growth will increase the requirements for fresh and cured pork and consolidate production at a considerably higher level than it is today.

We have shown that, on the basis of average yields, the production of coarse grains in Alberta might increase from 160 to 250 million bushels annually in the next twenty-five years. Thus ample supplies of feed grains will be available for the production of all the hogs for which there is likely to be a market in the period under review.

In 1954, an estimated 2,046,000 hogs were produced in Alberta; in 1980 the number produced will likely be in the neighborhood of 4 million head. We have indicated that more than 200 million pounds of pork was available for export from the province last year. We estimate that our exports of pork products will more than double to 427 million pounds in 1980.

The quantity of barley or its equivalent fed to hogs, will increase from 40 to 80 million bushels in the forecast period.

Dairy Products

In 1954, Alberta dairymen produced 1,391 million pounds of milk. Of the total, 1,067 million pounds were consumed in Alberta and 324 million pounds were exported. Amounting to the equivalent of 290 million pounds of milk, creamery butter comprised a high proportion of our dairy exports.

Assuming a 60 per cent increase in the population of the area served by Alberta's dairy industry in the next quarter century, we estimate changes in milk production and utilization in the province as follows:

MILK PRODUCTION AND UTILIZATION 1954 AND ESTIMATES FOR 1980

	1954		1980		1980 as
	'000 lbs.	% of Total	'000 lbs.	% of Total	% of 1954
Creamery Butter* _____	710,611	51.1	950,000	47.5	134
Dairy Butter* _____	68,866	5.0	65,000	3.3	94
Cheddar Cheese* _____	29,405	2.1	55,000	2.8	187
Ice Cream and Evaporated Milk, etc.* _____	75,140	5.4	130,000	6.5	173
Fluid Sales _____	271,206	19.5	525,000	26.2	194
Farm Home Consumed _____	132,400	9.5	150,000	7.5	113
Fed Farm Animals _____	102,970	7.4	125,000	6.2	121
Total _____	1,390,598	100.0	2,000,000	100.0	144

*Expressed in milk equivalents.

In recent years, the production of dairy products in Canada expanded faster than population increased; but the consumption of milk for all purposes decreased from 1,306 pounds per capita in 1944 to 1,027 pounds in 1954. Moreover, the dairy industry appears to be facing a period of change and re-adjustment. One of the results is likely to be an increase in production efficiency which will probably reduce the cost of dairy products relative to other foods. This could result in an increase in the per capita consumption of total dairy products.

Poultry Products

The development of Alberta's poultry industry in the last 10 years has been characterized by an increasing number of specialists in the business.

The number of flocks approved for the production of hatching eggs increased 65 per cent to number 1,043 in 1954, while the birds under flock approval increased 71 per cent to a total of 320,000.

Specialization in turkey production is pronounced. In the last 10 years, the number of flocks approved for producing hatchery eggs decreased 23.5 per cent while the number of birds under approval increased by 210.0 per cent.

Between 1950 and 1954, the production of poultry meat increased 51.0 per cent in Alberta compared to an increase of 44.3 per cent for Canada.

Comparative egg production figures for Canada and Alberta show the results of growing specialization and higher production per bird in our poultry industry. Between 1950 and 1954 laying hens on farms in Canada increased 11.1 per cent compared to 7.3 per cent for Alberta, while increases in the net production of eggs were 14.3 and 21.0 per cent for Canada and Alberta respectively.

The per capita consumption of poultry products in Canada would appear to be increasing. In 1950, the consumption of poultry meat was estimated at 22.0 pounds per capita; in 1954 consumption was 28.8 pounds. Per capita egg consumption increased from 23.0 to 24.4 dozen in the same period.

Increasing urbanization in this province will tend to increase further specialization in the poultry industry. The quality of poultry products sold off farms will improve. Advances in marketing, processing and merchandizing may be expected to widen the market for poultry products.

A detailed study on which to base a forecast of poultry production

during the next quarter century, cannot be undertaken. However, recent trends in the per capita consumption of poultry products will likely continue at a somewhat diminished rate. The development of the poultry industry in Alberta may be expected to increase faster than for Canada as a whole.

Beekeeping

In 1955 there were an estimated 1,500 beekeepers in Alberta operating 37,000 colonies of bees.

There is sufficient forage available in the province to support double the present honey bee population. However, the willingness of legume seed growers to pay for the services of honey bees as pollinators grows slowly.

In arriving at the estimates set out hereunder, it was assumed that (a) legume seed production will tend to expand in the province, (b) that the cultivation of more land surrounding fields of legume seed crops will reduce the nesting places of wild bee pollinators, and (c) that by 1980 a higher proportion of beekeepers' revenue will be obtained from rentals for pollination services.

Estimates on Beekeeping 1955 and 1980

	1955	1980
Persons Operating Beehives _____	1,500	2,000
Numbers of Hives per Person _____	25	40
Total Number Hives _____	37,000	80,000
Average Production per Hive (lbs.) _____	120	100
Total Production of Honey (lbs.) _____	4,500,000	8,000,000
Beeswax (lbs.) _____	60,000	120,000
Colonies Requested by Seed Growers for Pollination _____	12,000	40,000
Returns from Sale of Products and Pollination Services (\$) _____	1,000,000	2,500,000

Farm Mechanization

Considerable progress has been made in the agricultural engineering field in the last 50 years.

The modern era in farm mechanization began about the turn of the century. However, progress was slow until about 1910 when gasoline traction engines were introduced.

Most of the developments that took place in mechanization in the following 30 years were based on the use of the gasoline engine. The combine, forage harvester, sprayers, etc., were all developed as a direct result of tractive power in units which could be utilized on the average farm.

Few, if any, radical changes occurred in farm mechanization after 1940. However, existing machines were improved and made more efficient.

What progress will be made in the next 25 years? It appears unlikely that radically new techniques will be introduced. There will be further improvements made. A turbine-type engine may replace the reciprocating engine which might result in greater efficiency in the use of power.

Aircraft in agricultural production will likely be limited to the application of sprays, etc. It is possible that a "Rollagon" (low pressure pneumatic roller) might be used on agricultural machinery thus increasing its versatility.

The automatic operation (automation) of farm machinery is possible but cost would be a limiting factor.

It would seem desirable to develop soil conservation machinery for contouring and terracing on a large scale. The development of equipment for land clearing and to permit the better handling of thin soils in areas available for settlement would hasten the development of our agricultural resources in the grey wooded soils zone.

Greater emphasis will likely be placed on the development of farmstead equipment that will reduce labour requirements in live stock production.

Farm Buildings

The type of farm buildings constructed in a quarter century, will differ considerably from the buildings now in general use.

Utility-type structures that serve several uses will replace buildings now used for specific purposes. They will be of the round-roofed or trussed-rafter type, giving an interior not broken by posts or partitions.

Buildings for grain storage will be built on the upright cylindrical pattern, possibly with hopper floors and utilizing mechanical loading and unloading equipment.

The prefabrication of farm service buildings will likely be widespread.

Animal housing will continue along the same lines recently introduced in dairy management, providing for the loose housing of live stock and mechanical handling of feed and manure.

The whole farm lay-out and building design will be adapted along functional lines to take advantage of mechanical equipment. The electrification of farmsteads and the installation of water and sewerage systems in farm homes should be almost completed in the period.

TABLE I
Area of Land in Occupied Farms in Alberta by Census Divisions—
1931 to 1951

Census Divisions	1931	1936	1941	1946	1951
— thousands of acres —					
1	3,570	4,023	4,583	4,026	4,230
2	2,554	2,678	2,650	2,482	2,713
3	3,091	3,310	3,420	2,520	2,920
4	2,771	2,764	2,796	2,689	2,786
5	3,615	3,011	3,492	4,099	4,223
6	3,931	3,979	4,168	3,866	4,202
7	3,436	3,486	3,606	3,683	3,804
8	3,536	3,673	3,844	3,716	3,840
9	1,157	1,380	1,479	1,440	1,527
10	3,213	3,424	3,580	3,492	3,609
11	2,003	2,153	2,257	2,249	2,324
12	530	595	657	614	688
13	1,100	1,272	1,453	1,394	1,512
14	1,964	2,177	2,363	2,260	2,582
15	630	629	719	719	954
16	1,804	1,864	2,067	2,047	2,389
17	72	122	145	156	157
Province	38,977	40,540	43,279	41,452	44,460

TABLE II

Area of Improved Land on Farms in Alberta by Census Divisions—
1931 to 1951

Census Divisions	1931	1936	1941	1946	1951
— thousands of acres —					
1	1,160	1,353	1,577	1,608	1,756
2	1,140	1,179	1,288	1,251	1,358
3	745	665	740	681	788
4	1,707	1,704	1,783	1,722	1,869
5	1,800	1,469	1,378	1,300	1,363
6	2,368	2,404	2,562	2,535	2,696
7	1,869	1,866	1,841	1,802	1,864
8	1,773	1,856	2,034	2,041	2,244
9	473	556	661	675	756
10	1,728	1,839	2,037	1,978	2,150
11	997	1,106	1,250	1,256	1,363
12	119	146	185	186	230
13	324	394	518	548	651
14	708	830	1,009	1,059	1,346
15	150	183	251	282	439
16	674	779	951	1,029	1,304
17	15	34	60	79	94
Province	17,750	18,363	20,125	20,032	22,271

TABLE III

Area in Field Crops in Alberta for 1931, 1941 and 1951

Land Use	1931	1941	1951	1951 as Percent of 1931
— thousands of acres —				
Wheat	7,943	6,556	6,424	81
Oats	2,466	2,857	2,854	116
Barley	710	1,579	3,041	428
Other Grains	201	335	501	249
Tame Hay	297	602	1,206	406
Grain Hay, etc.	364	268	283	78
Sugar Beets	12	23	36	300
Other Crops	46	35	82	178
Total Crops	12,039	12,255	14,427	120
Improved Pasture	525	626	1,113	212
Summerfallow	4,547	6,546	6,195	136
Other Improved Land	637	698	536	84
Total	17,748	20,125	22,271	125

TABLE IV

The Area Seeded to Wheat in Alberta Compared With the Total Area in Crops
by Census Divisions—1931 and 1951

Census Divisions	1931			1951		
	Area in Crop	Area Seeded to Wheat	Percent in Wheat	Area in Crop	Area Seeded to Wheat	Percent in Wheat
	— '000 acres —			— '000 acres —		
1	672	548	81.5	998	774	77.6
2	668	440	65.9	777	498	64.1
3	424	320	75.5	502	308	61.4
4	1,012	770	76.1	1,066	767	72.0
5	1,086	850	78.3	799	530	66.3
6	1,582	1,098	69.4	1,675	868	51.8
7	1,344	1,032	76.8	1,116	598	53.6
8	1,362	744	54.6	1,517	425	28.0
9	352	148	42.0	541	51	9.4
10	1,315	870	66.2	1,456	603	41.4
11	759	311	41.0	988	138	14.0
12	85	33	38.8	161	30	18.6
13	242	139	57.4	469	156	33.3
14	521	286	54.9	986	216	21.9
15	111	41	36.9	337	103	30.6
16	491	306	62.3	960	327	34.1
17	11	6	54.5	63	30	47.6
Province	12,037	7,942	66.0	14,411	6,422	44.6

TABLE V

Areas of Improved Land and Land Seeded to Wheat in Alberta—
1931 and 1951

Census Divisions	1931			1951		
	Area of Improved Land	Area Seeded to Wheat	Percent in Wheat	Area of Improved Land	Area Seeded to Wheat	Percent in Wheat
	— '000 acres —			— '000 acres —		
1	1,160	548	47	1,756	774	44
2	1,140	440	39	1,358	498	37
3	745	320	43	788	308	39
4	1,707	770	45	1,869	767	41
5	1,800	850	47	1,363	530	39
6	2,368	1,098	46	2,696	868	32
7	1,869	1,032	55	1,864	598	32
8	1,773	744	42	2,244	425	19
9	473	148	31	756	51	7
10	1,728	870	50	2,150	603	28
11	997	311	31	1,363	138	10
12	119	33	28	230	30	13
13	324	139	43	651	156	24
14	708	286	40	1,346	216	16
15	150	41	27	439	103	23
16	674	306	45	1,304	327	25
17	15	6	40	94	30	32
Province	17,750	7,942	45	22,271	6,422	29

TABLE VI

The Area Seeded to Oats and Barley and Summerfallow by Census Divisions in 1931 and 1951

Census Divisions	Oats		Barley		Summerfallow	
	1931	1951	1931	1951	1931	1951
1	44	26	8	84	412	676
2	78	66	39	82	398	465
3	43	39	16	41	133	218
4	141	83	44	110	616	648
5	168	108	9	62	545	477
6	306	251	95	339	664	828
7	221	264	28	113	452	635
8	363	357	151	528	304	533
9	105	105	48	266	86	138
10	327	408	55	325	314	537
11	217	306	128	390	177	236
12	28	44	6	46	22	41
13	74	109	15	123	64	133
14	140	254	54	366	144	258
15	58	101	4	58	26	73
16	150	321	9	102	139	273
17	4	12		6	2	25
Province	2,467	2,854	709	3,041	4,548	6,194

*Less than 500

Note: See Table 4 for comparison of acreage in wheat.

TABLE VII

Cattle and Calves on Farms in Alberta by Census Divisions—
1931 to 1951

Census Divisions	1931	1936	1941	1946	1951	1955*
— thousand head —						
1	88	104	80	83	83	92
2	108	126	112	136	150	214
3	54	75	52	65	81	100
4	93	106	98	124	118	146
5	58	70	63	82	84	118
6	124	171	155	205	200	281
7	89	126	111	136	128	174
8	142	214	184	209	202	270
9	53	80	68	81	74	97
10	104	153	124	148	132	179
11	78	110	99	113	111	130
12	10	16	17	19	19	25
13	35	55	50	58	50	71
14	47	74	70	81	77	108
15	12	17	17	17	14	20
16	29	53	38	40	38	58
17	2	4	4	4	2	2
Province	1,126	1,554	1,342	1,601	1,563	2,085

*Estimated

TABLE VIII

Sheep and Lambs on Farms in Alberta by Census Divisions—
1931 to 1951

Census Divisions	1931	1936	1941	1946	1951	1955**
— thousand head —						
1	171	141	115	110	47	—
2	160	138	136	130	79	—
3	138	157	139	112	56	—
4	46	36	34	35	12	—
5	32	36	21	38	12	—
6	63	58	42	37	19	—
7	18	20	18	16	6	—
8	50	56	46	42	20	—
9	25	28	25	37	16	—
10	17	23	17	15	10	—
11	24	25	26	32	19	—
12	4	6	7	10	5	—
13	13	13	13	17	8	—
14	18	20	26	25	14	—
15	1	2	3	2	2	—
16	6	7	7	9	5	—
17	*	*	*	1	*	—
Province	786	766	675	668	330	460

*Less than 500

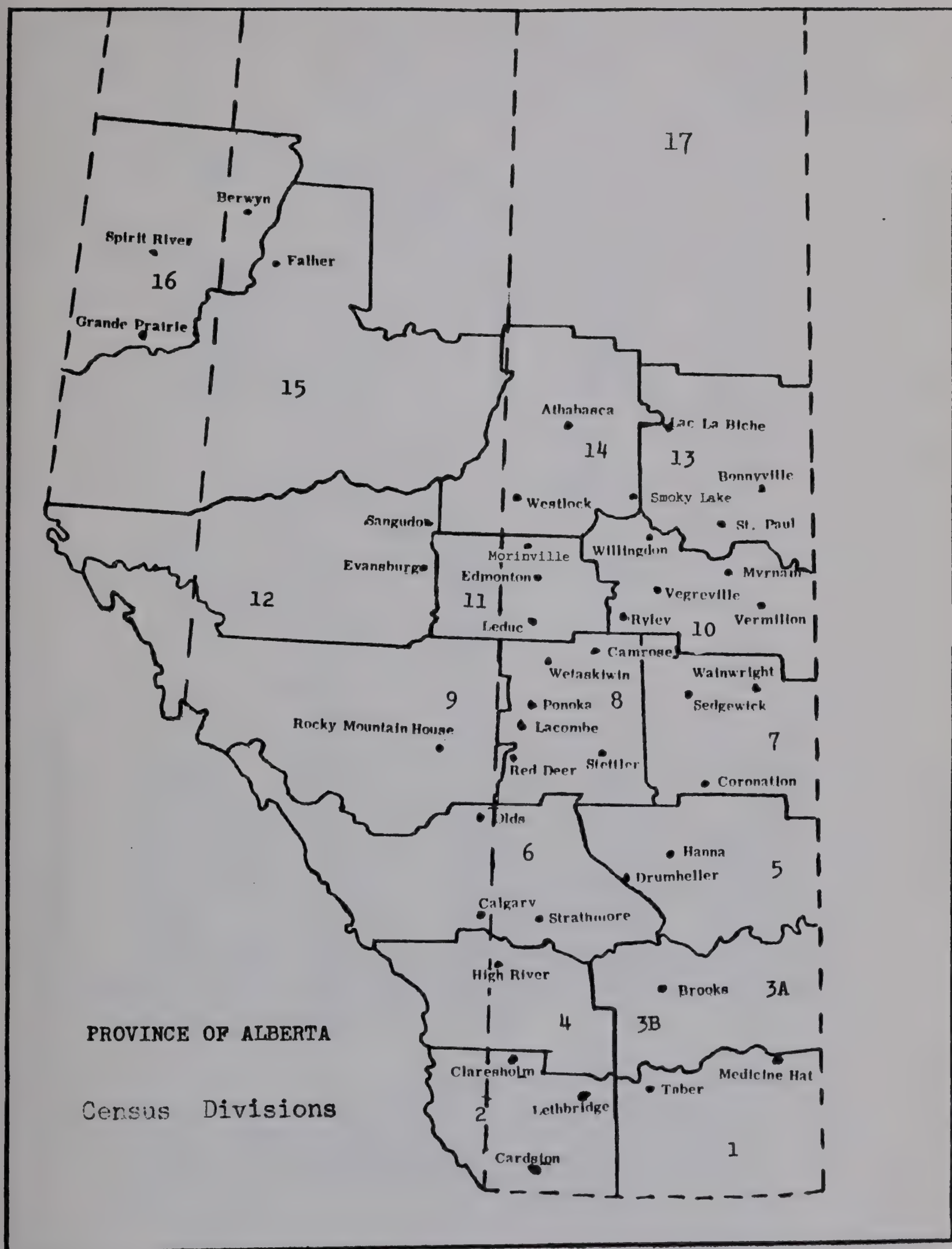
**Estimated. Census division estimates not available.

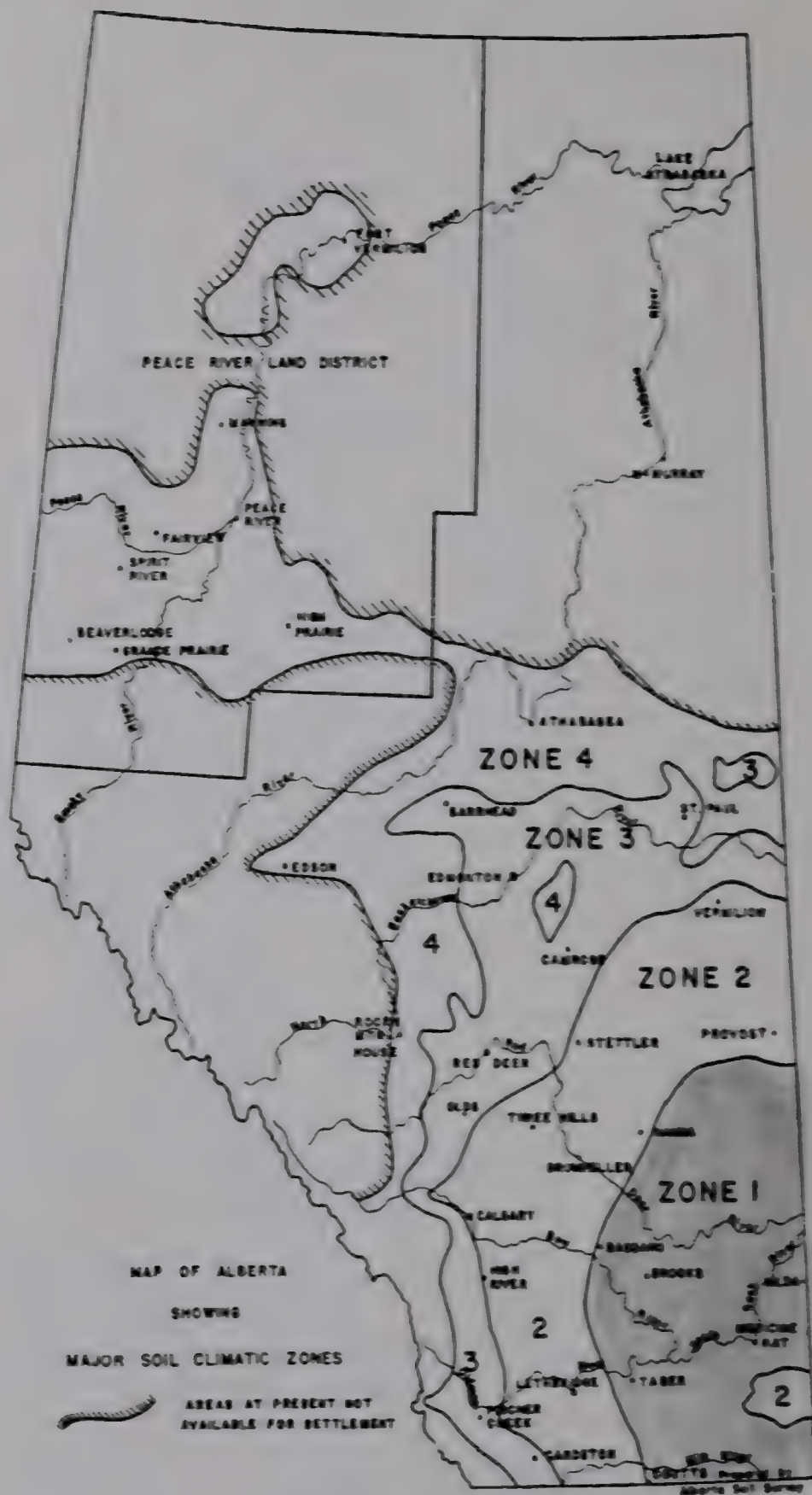
TABLE IX

Swine on Farms in Alberta by Census Divisions—
1931 to 1951

Census Divisions	1931	1936	1941	1946	1951	1955*
— thousand head —						
1	26	20	25	14	14	26
2	82	42	72	38	40	93
3	26	17	39	18	25	38
4	73	43	69	37	31	55
5	20	10	18	9	8	18
6	119	108	194	100	85	137
7	51	34	71	34	34	72
8	146	139	262	158	159	255
9	61	52	120	66	74	118
10	128	121	204	119	104	202
11	132	127	226	132	132	201
12	12	8	28	12	18	20
13	41	38	94	53	60	114
14	82	66	171	102	98	170
15	14	12	35	17	16	31
16	37	38	72	28	31	67
17	2	3	6	3	2	2
Province	1,052	878	1,706	940	931	1,619

*Estimated





Zone 1—The brown soil zone.

Zone 2—The dark brown and thin black soil zone.

Zone 3—The black and grey-black soil zone.

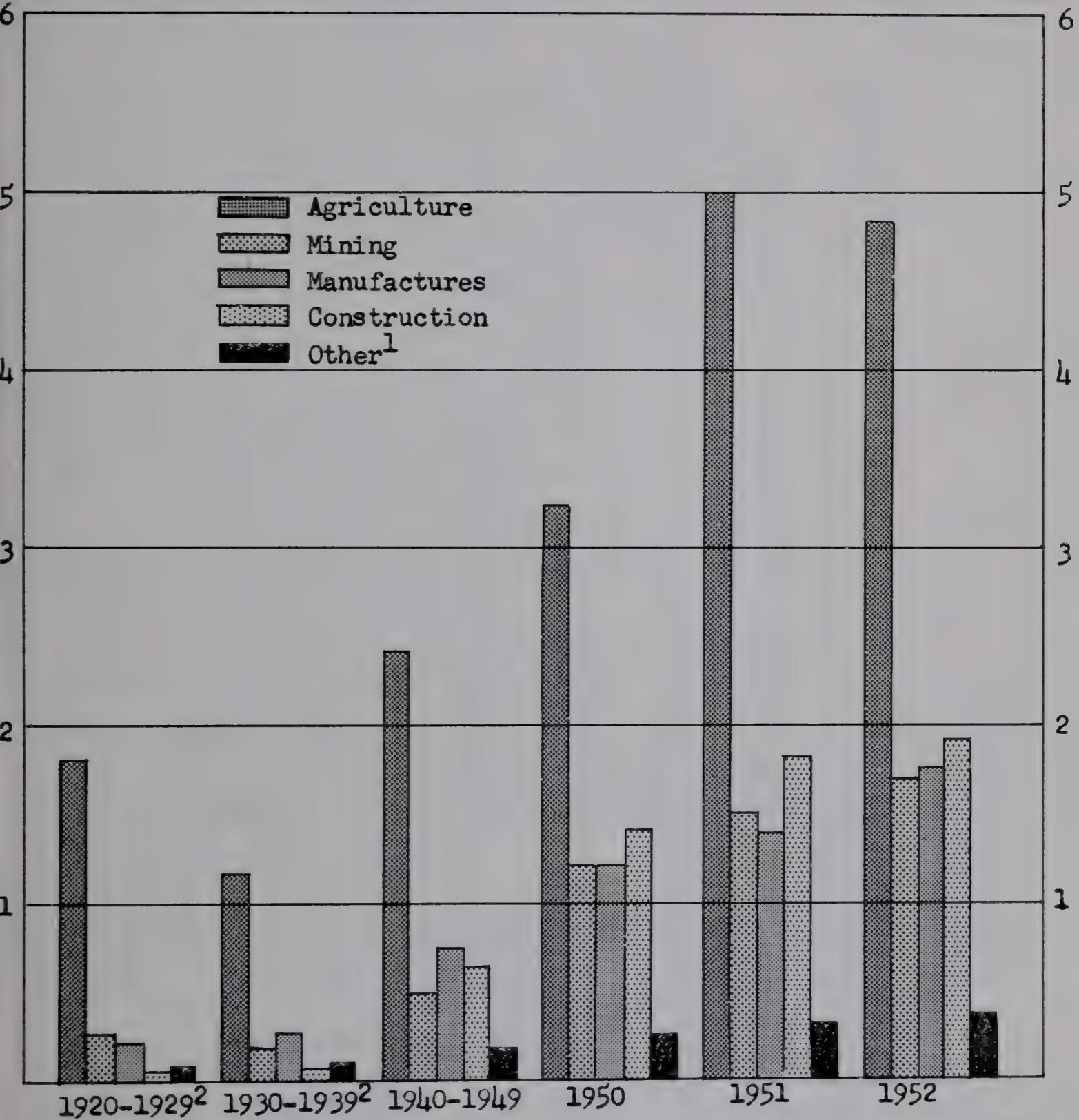
Zone 4—The grey wooded soil zone. (Part of Peace River section probably should be considered more like Zone 3.)

CHART 1

Net Value of Commodity Production by Industries

One Hundred Million Dollars

One Hundred Million Dollars



1. Includes electric power, forestry, trapping and fisheries.

2. Estimates for 1920 to 1939 are not strictly comparable to estimates for later years.

CHART 2

Index of Physical Volume of Agricultural
Production, Alberta, 1935 - 1954
1935-39 = 100

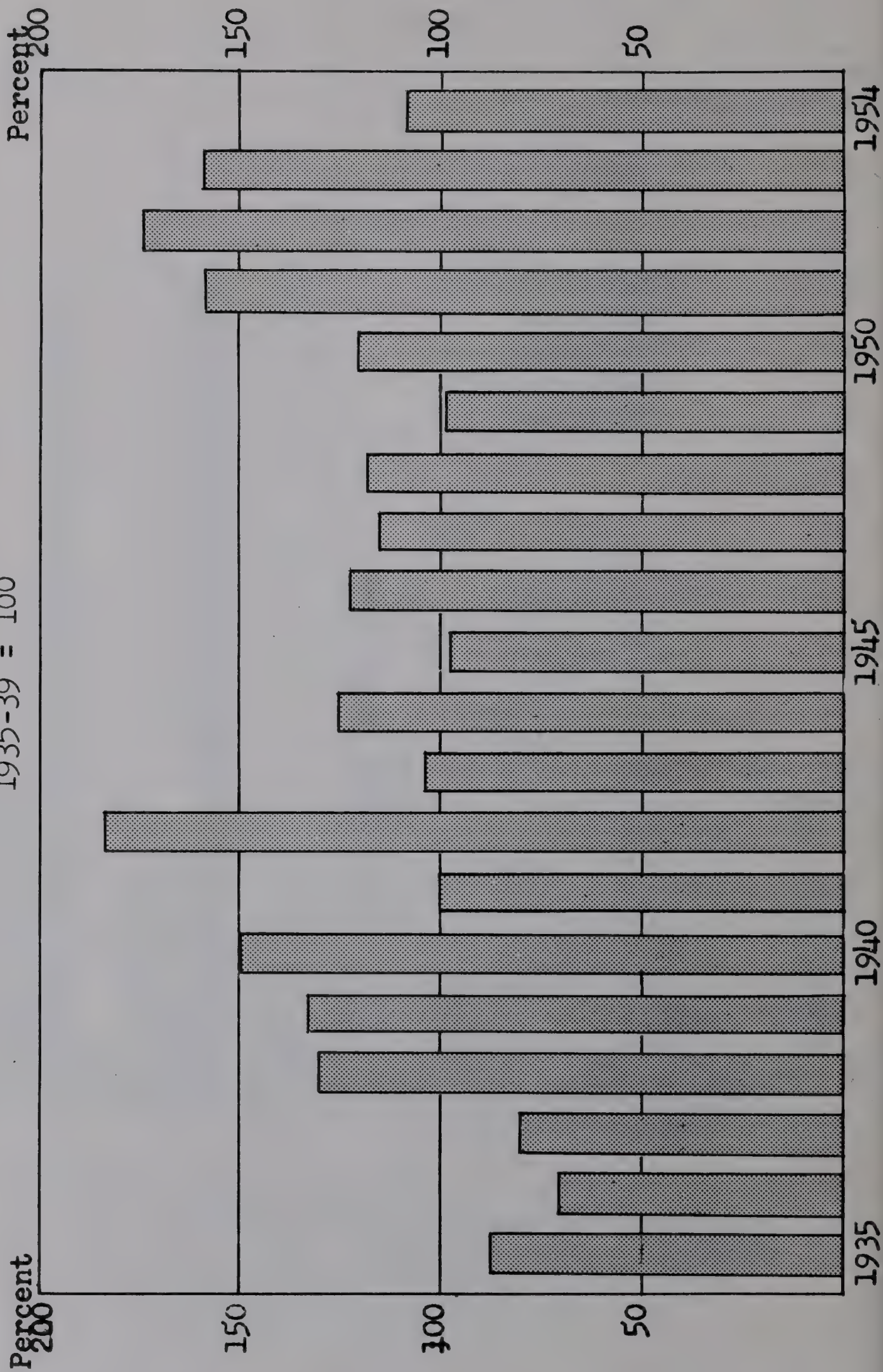
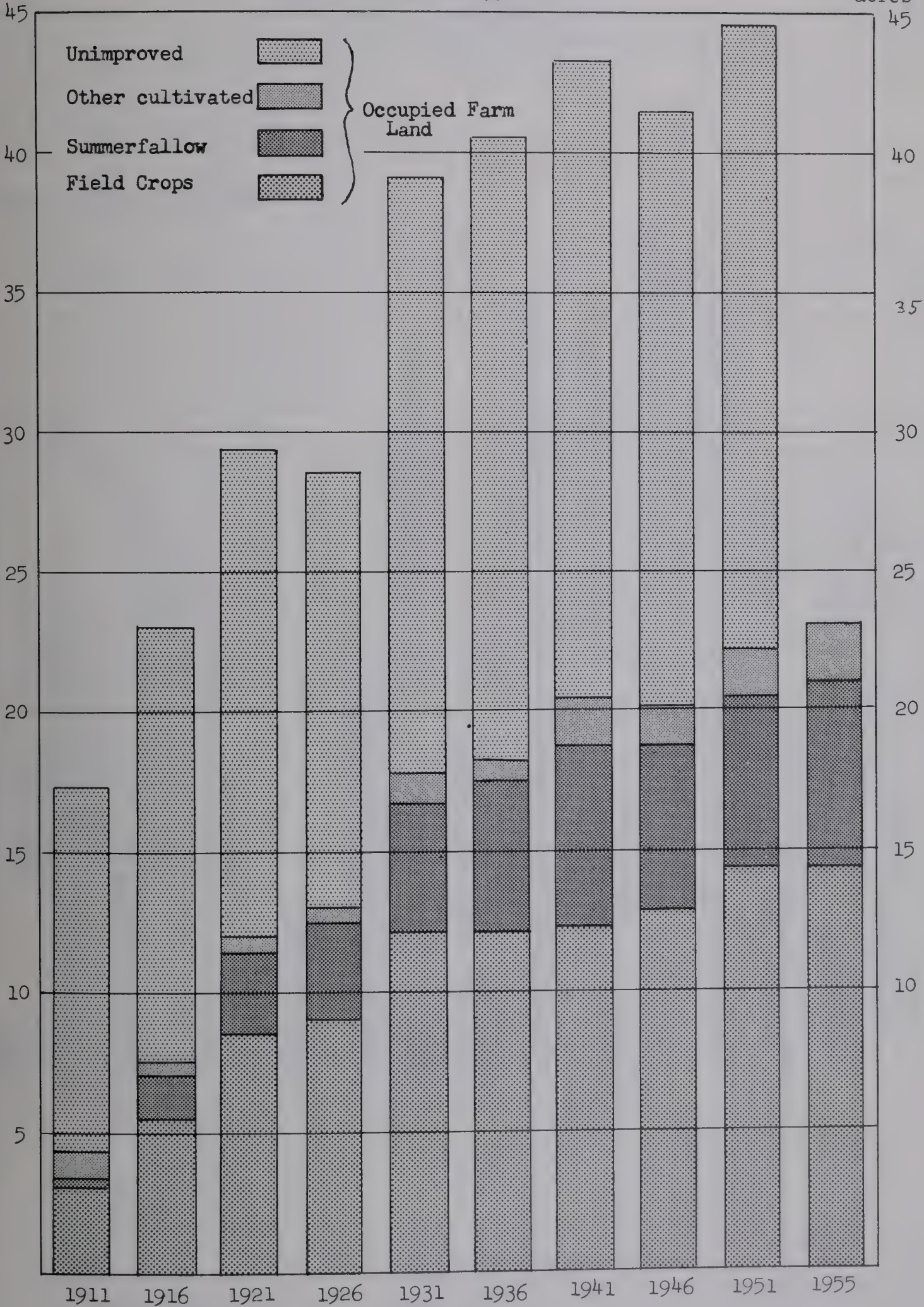


CHART 3

Area in Occupied Farms and
Cultivated Land in Crop,
Summerfallow and in "Other
Uses" by Census Years,
1911 to 1951

Million
acres

Million
acres



I Estimated

CHART 4

Area of Occupied Farm Land
1931 and 1951 by
Census Divisions

Millions
acres

Millions
acres

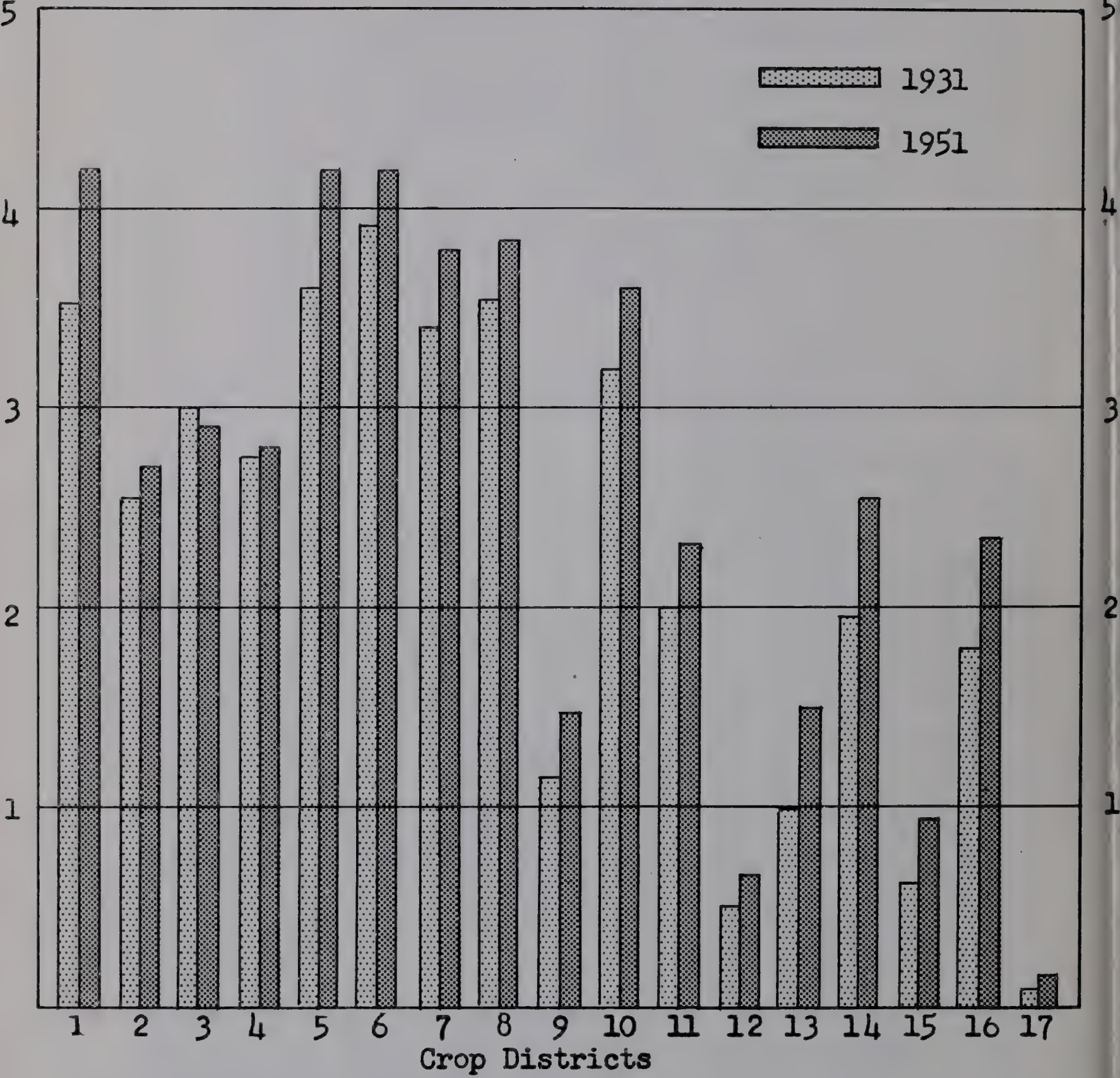


CHART 5

Improved Land in Alberta
by Census Divisions
- 1931 and 1951 -

lion
res

Million
acres

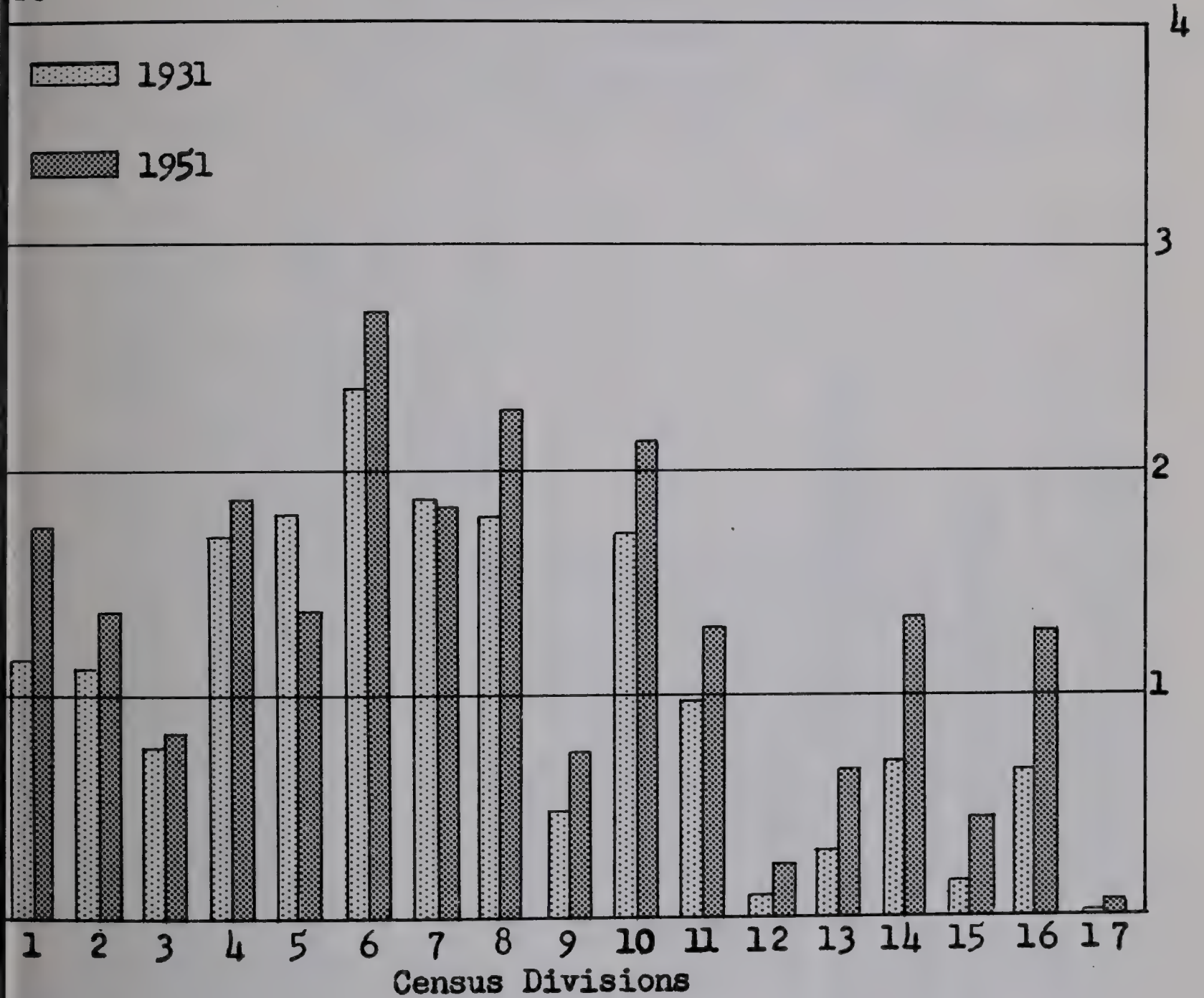


CHART 6

Unimproved Farm Land, Tree Covered
Area Excluded, in Alberta by
Census Divisions - 1952

Million
acres

Million
acres

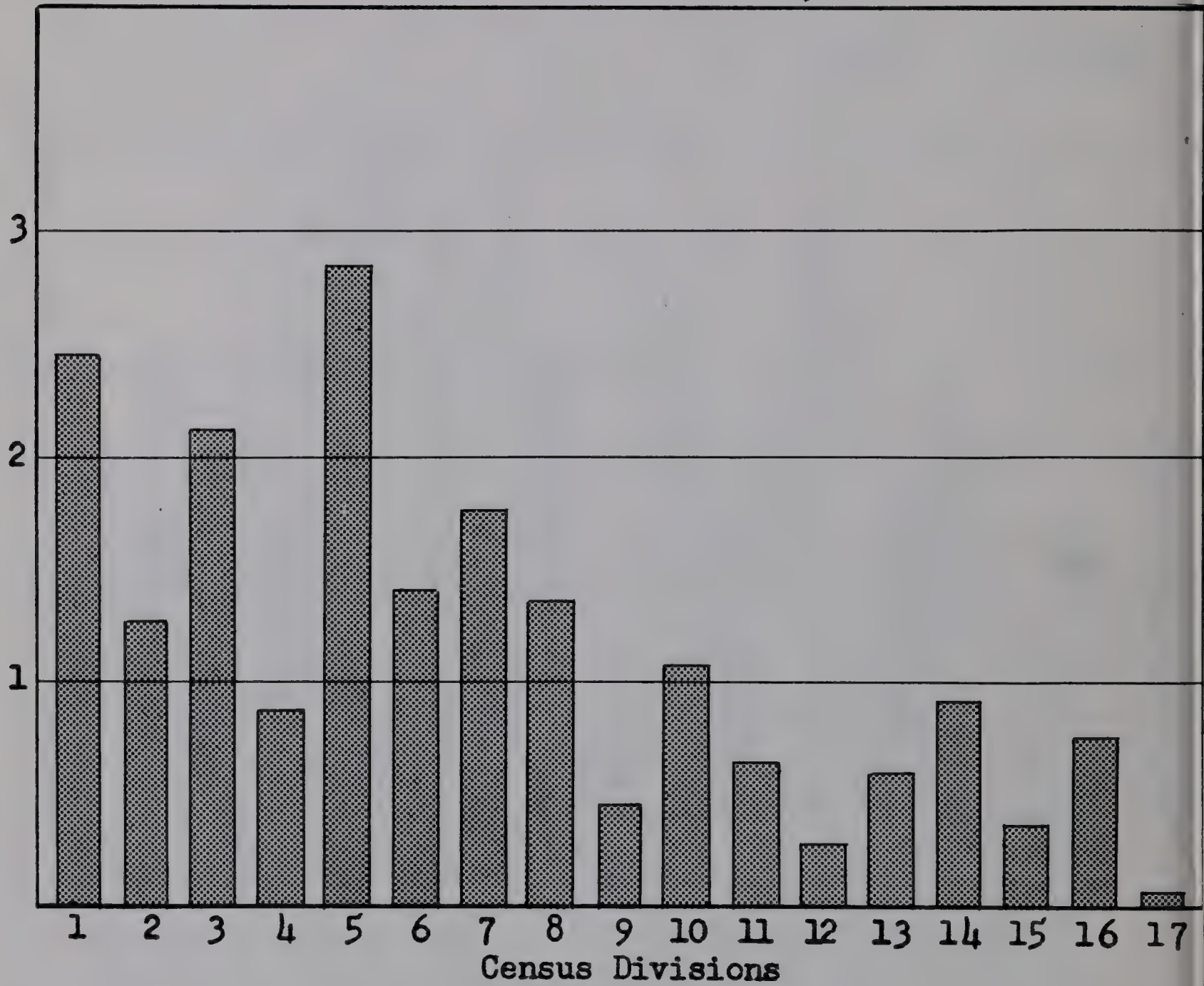


CHART 7

Summerfallow in Alberta Expressed as a
Percentage of Total Improved Land on
Farms by Census Divisions
-1931 and 1951-

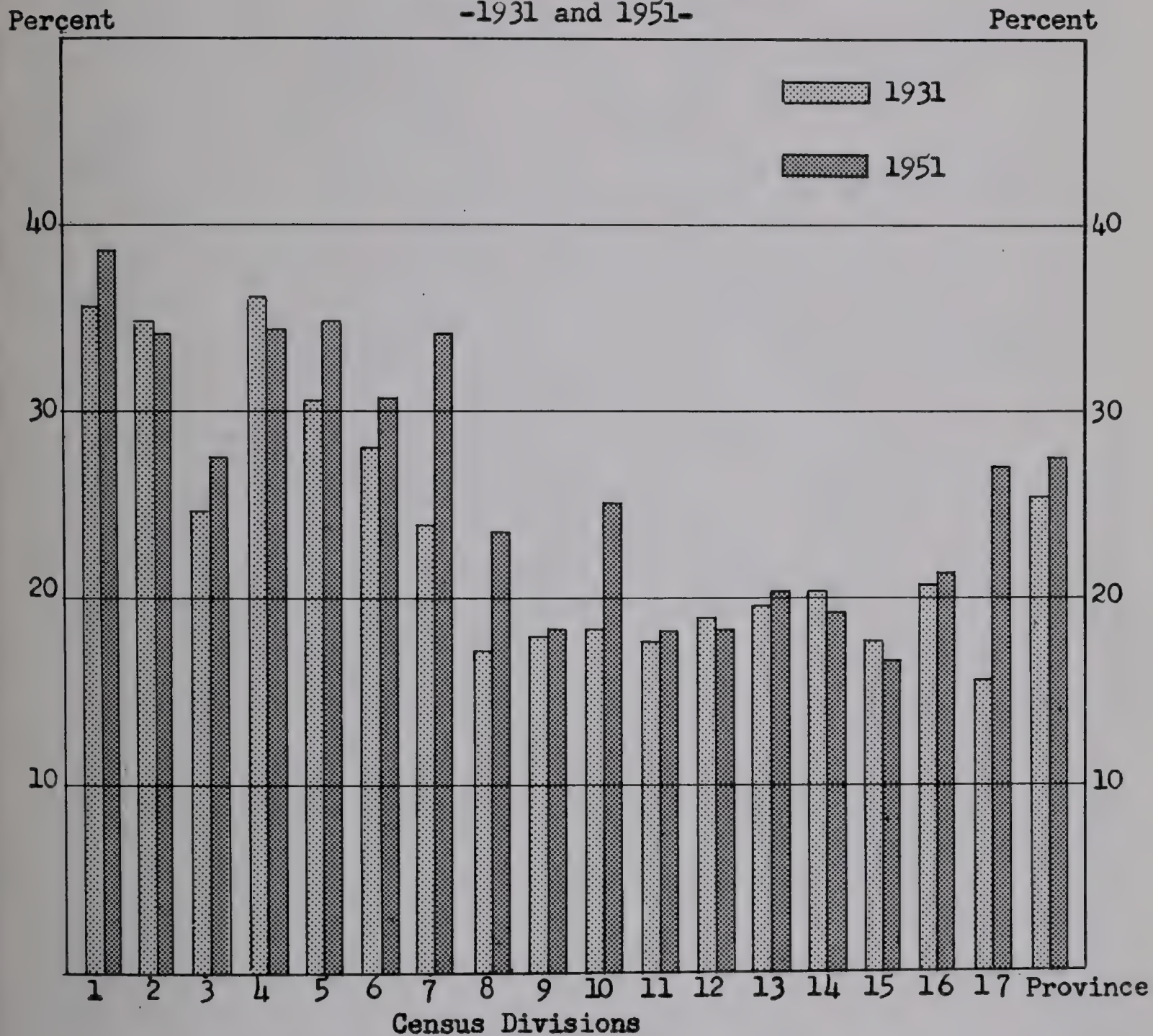


Chart 8

Area Seeded to Wheat, Oats, Barley, Other Grains, Tame Hay
and Pasture, and Summerfallow, 1908 to 1955

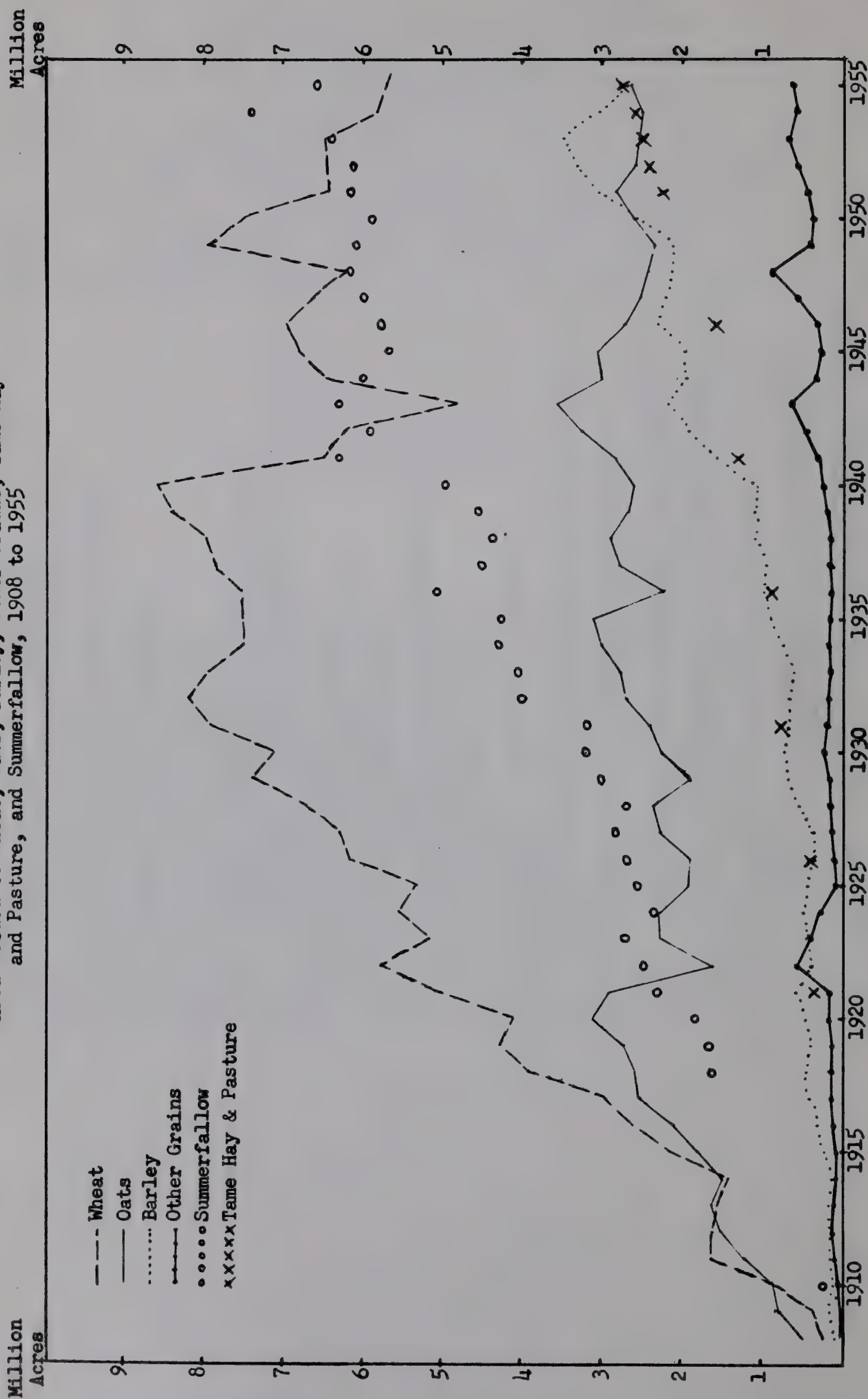
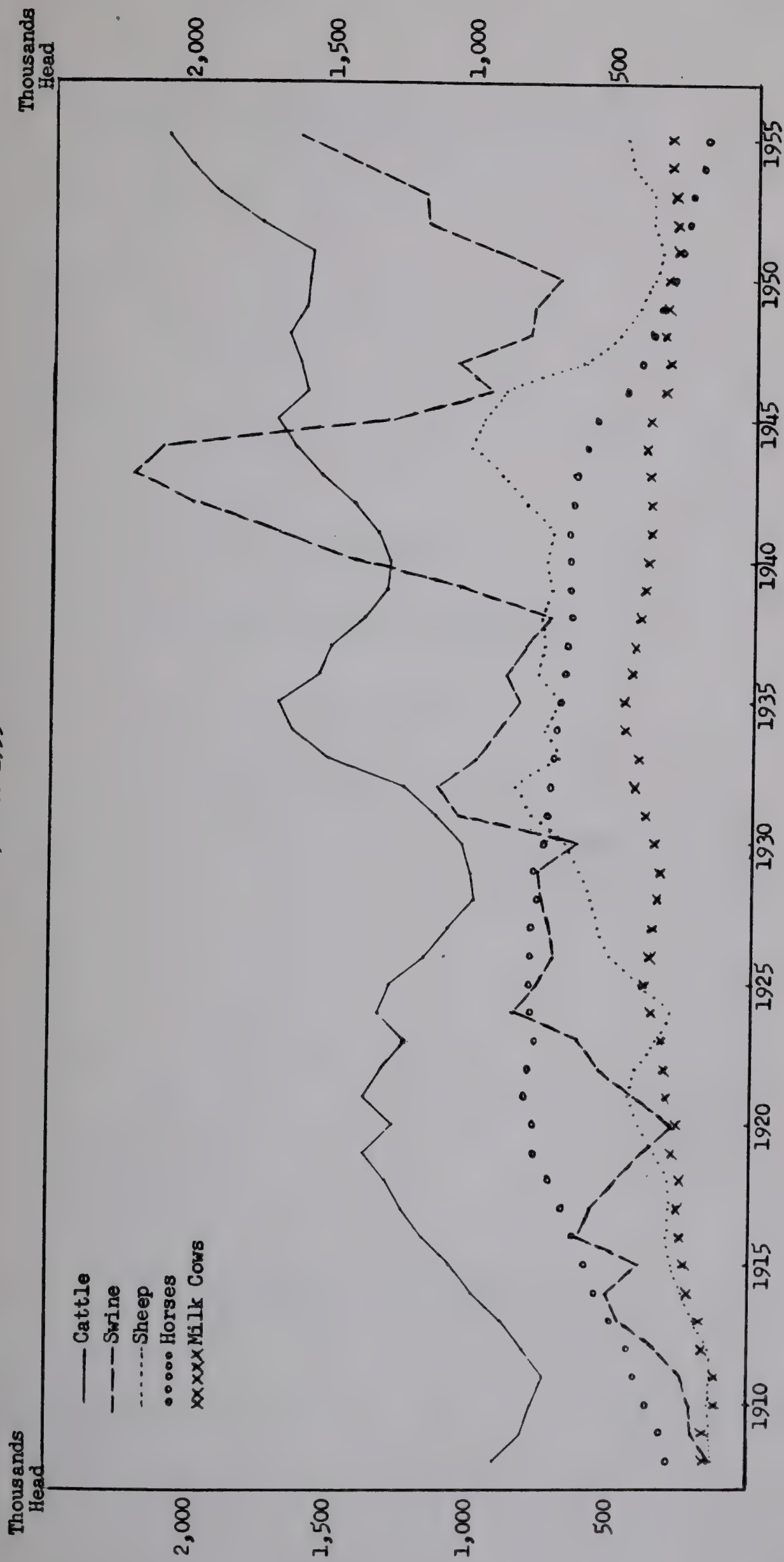


Chart 9
Live Stock Population in Alberta at June 1,
1908 to 1955



Alberta's Economic Prospects

WATER RESERVES IN MAJOR RIVERS

Prepared by

Alberta Department of Agriculture

F. L. Grindley

Director of Water Resources

Dr. Lawrence E. Kindt,
Consulting Economist.

Department of Agriculture

HONOURABLE L. C. HALMRAST,
Minister

R. M. PUTNAM,
Deputy Minister

December, 1955.

The need for Storage Reservoirs on the Eastern Slope of the Rockies for flood control and augmentation of low flow for domestic and industrial use.

Partly as the result of a general increase in population and partly as the result of expanding petro-chemical and other industries, there has been and will continue to be an increasing use of the flow of our rivers. At high and ordinary stages of flow this demand on the supply presents no problem. It will be only during the months of low flow that the problem of supply will need attention.

There are two approaches to this problem. The first approach is to conserve the available supply by careful usage and the second is to build reservoirs to retain high water flow for consumption when the flow is low.

At this point it is interesting to examine the reason for extreme fluctuations in flow of our Eastern Rockies streams. During the winter months there are great accumulations of snow and ice in the higher levels of the Rockies. At an elevation of 10,000 feet above sea level the snow depths can be as much as 16 feet. These snow depths gradually decrease as we descend. Even at an elevation of 6,000 feet above sea level, however, we have important snow depths. When melting takes place in the summer months the accumulations of snow and ice at the lower elevations melt first and in June this snow melt movement reaches its peak. Flooding of low lying lands can occur in this period.

At higher elevations the snow and ice melt is much slower and on the higher peaks the effect of the higher summer temperatures goes virtually unnoticed. It is from these higher elevations that we get our low flow in the winter and it is this flow which is of vital importance. This description of runoff from the Rockies is very general and other factors enter the picture, but the effect of elevation above sea level is of primary importance. It is interesting to note that rivers which rise on the 7,000 foot level are altogether different in their flow regime to rivers that rise on the 10,000 foot level. Our important rivers, such as the North and South Saskatchewan, Athabasca and Peace all have their main sources reaching to the 10,000 foot level.

Rivers rising on the 7,000 foot level or lower may be more properly described as foothills streams. They are much "flashier" in their flow than the rivers that rise in the high peaks of the Rockies. These foothill streams or rivers are extremely erratic and under conditions of extreme drought they may dry up for short periods of time.

A recent issue of the Lethbridge Herald drew attention to the fact that there was not enough water in the Oldman River at low stage to support any industrial development in that city or the area contiguous to Lethbridge. The Lethbridge area is the centre of Alberta's irrigation development and water is diverted from the Oldman River above Lethbridge for irrigation. Diversions of water for irrigation usually cease by October 20, but by that time the river levels have started their usual fall and winter drop. As recently as September 19, 1951 the flow in the St. Mary River at Lethbridge dropped to 9.5 cubic feet per second. The flow in the Oldman River at Monarch dropped to 51 cubic feet per second on October 10, 1950. These are both large mountain streams but there is a real need for storage reservoirs indicated.

The picture becomes brighter as we proceed north. The low flow in the Bow River at Calgary is now in excess of 2,000 c.f.s. due to the regu-

lation afforded by hydroelectric dams upstream. The City of Calgary has recently become concerned that their water supply from the Glenmore Dam (Elbow River) will be insufficient for their needs. They are proposing to supplement their supply from the Bow River and possibly from underground sources.

The minimum flow of the North Saskatchewan at Edmonton was on January 1, 1950 when the flow was measured at 220 cubic feet per second. This contrasts sharply with the flood flow of 204,500 c.f.s. Upstream storage is required on this river.

The Athabaska River measured at Athabaska registered a low flow reading of 1,490 c.f.s. in January 1953. The Athabaska is an important navigation stream. Much of the heavy freight for the gold mines and uranium mines is transported on this stream. A typical industrial development will be located at Hinton on the Athabaska River consisting of a large pulp mill. This mill will require 25,000,000 gallons of water per day and this is a sufficient supply for a large city.

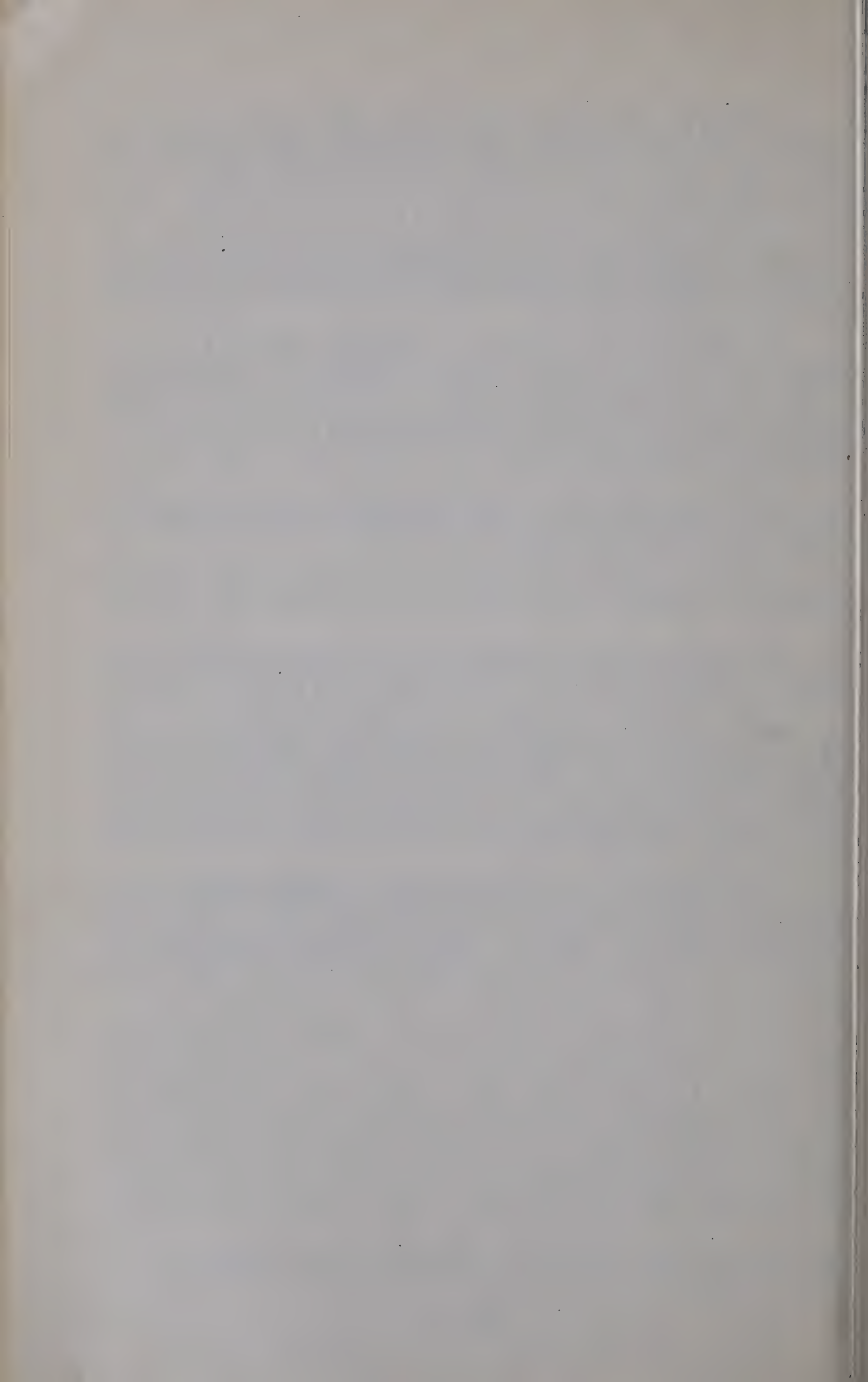
Many other figures could be quoted to indicate the tremendous fluctuations of our rivers. The above is only a sketchy presentation to outline the serious nature of these fluctuations.

If the present industrial growth of the western provinces continues at its present high state, there will be water shortages within a ten or twenty year period.

Fortunately, there are reservoir sites on these rivers and these should be investigated in detail at an early date. It is submitted that the upstream sites in the foothills are the most economical and most feasible to build.

It is important to note that the benefits obtained by improving the flow characteristics of our Eastern Rockies rivers will be shared by the three prairie provinces. There are several hydroelectric sites on the Saskatchewan River in both Saskatchewan and Manitoba. The value of these sites will be greatly enhanced by controlled flow. In addition, there are land reclamation projects on the Saskatchewan delta. Controlled flow is essential for the success of these projects.

Engineers for the various industries being established in Alberta have studied our water flow records and have expressed concern about the low flow readings. It is their hope that something will be done to correct the critically low winter flow. When one considers the huge investment in these industries it is not difficult to understand this concern over the reliability of water flow.



Alberta's Economic Prospects

Section II B.

ENERGY RESOURCES OF ALBERTA

- | | |
|---------------------------------------|--|
| 1. Introduction | N. Berkowitz, Senior Research Chemist,
Coal, Research Council of Alberta. |
| 2. Summary and Conclusions | R. M. Elofson, Senior Research Chemist,
Coal, Research Council of Alberta. |
| 3. Coal | W. A. Lang, Chief Research Chemist,
Coal, and N. Berkowitz, Senior Research
Chemist, Coal, Research Council of Al-
berta. |
| 4. Crude Petroleum and
Natural Gas | R. J. Cooper, Statistician, Petroleum and
Natural Gas Conservation Board. |
| 5. Athabasca Oil Sands | K. A. Clark, Consultant, Research
Council of Alberta. |
| 6. Electrical Energy | J. G. MacGregor, Chairman, and J. L.
Reid, Secretary, Alberta Power Com-
mission. |
| 7. Nuclear Energy | D. B. Scott, Professor, Department of
Physics, University of Alberta. |

December 1955

II B. Energy Resources of Alberta

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INTRODUCTION

N. Berkowitz,
Senior Research Chemist, Coal,
Research Council of Alberta.

1. INTRODUCTION

Energy may be defined as heat and the ability to perform work with a minimum involvement of human labour and is, as such, the unquestioned keystone of a people's existence. Efforts to establish current energy production and consumption patterns and to assess future requirements need therefore no justification. They are no more than an assurance against later energy wants and a consequent dislocation of orderly economic advancement. And this point gains added significance when it is borne in mind that several alternative energy resources may be available, and that much time, training of man-power and capital expenditure is necessary in order to develop potential into actual energy-producing sources, or to effect substitutions when an existing balance is disturbed by suddenly increased demand and changing consumer habits.

But there are several serious difficulties in the way of an analysis of future energy requirements. The energy potential and overall energy demand ten, twenty or even thirty years hence can generally be estimated with some degree of precision on the basis of projected population figures and per capita consumption. Reliable data bearing on these matters have been established by several eminently authoritative economic surveys in Canada and in the United States of America.* Individual contributions of competing (alternative) fuels to the total energy production, however, are necessarily much more speculative. Changes in consumer habits and in the costs of alternative fuels; industrial growth; the development of export markets for energy or energy source materials; technological advances in the winning and utilization of fuels—all these combine to make projections of energy requirements met from specific sources very uncertain. Such projections are, in fact, frequently no more than 'informed guesses' based upon plausible but not necessarily time-resistant presumptions. One example may suffice to illustrate this point and to indicate the rapidity with which the relative economic importance of competing fuels may change:

During the first decade of the 20th century, some 79% of the U.S. energy supply was derived from coal, but by 1950, that figure had fallen to 42%. During the same interval, the contribution of petroleum had increased from 5.5% of the total to 35%, that of natural gas from 3% to 18%, and that of hydro-electric power from 3% to 4.5%. Wood, which in 1900 had accounted for nearly 14% of the total fuel supply, had dwindled into insignificance by 1950.*

Considerations such as these are perhaps always valid. But they are particularly pertinent to studies of the energy resources and requirements of Alberta which is endowed with an abundance of all types of fossil fuels and very considerable resources of potential and developed hydro-electric power. The discovery of extensive petroleum and natural gas reservoirs in the Province and the need to find local outlets for these fuels has, since 1949, resulted in intense competition between alternative fuels and has, despite a very rapid increase in demand for power, also brought about profound changes in energy production and consumption habits. Within less than five years, petroleum and natural gas (and more especially the latter) have progressively displaced coal from the domestic markets; and natural gas, often

*The President's Materials Policy Commission, 1952. Vol. III; C. L. O'Brian; "Canadian Energy Sources", Trans. CIM & M., Vol. LVI, 1953.

*Ayres and Scarlott, "Energy Sources—The Wealth of the World", McGraw-Hill, 1952.

at abnormally low well-head prices dictated by the lack of more remunerative outlets, has also made substantial inroads into industrial markets and power generation. At the same time, railroads—traditionally among coal's best customers—have carried out extensive dieselization programs and thereby further cut into coal demands. Between 1950 and 1955, railroad requirements of coal fell from about 2.5 million tons per year to less than 0.6 million tons.

These changes, however, are not necessarily indicative of future trends. The domestic markets may possibly be assumed to remain relatively stable; for, habits of the domestic consumer, particularly in an era of economic prosperity, will be determined by convenience rather than mere costs. In other words, unless there are large increases in the price of natural gas, the prevailing tendency for gas to establish itself as the dominant domestic fuel is likely to continue. But the industrial markets, and particularly power generating plants, are bound to be much more sensitive to possible future price changes and to react to them fairly quickly. They are liable to change from one fuel to another whenever costs make such a move economically attractive. That petroleum and natural gas will continue to play a large part in Alberta's total energy consumption (and a very much larger one still in the Province's economy as a whole) is of course indisputable. It is, however, also almost a foregone conclusion that thermal power stations may increasingly come to rely on coal as export markets for petroleum and natural gas are developed and the well-head prices of these commodities rise (as they have done, for example, in Texas). In fact, were the general situation in Alberta to follow the developments that have occurred in the USA, one may anticipate a rising demand for coal regardless of the ultimate disposition of Alberta petroleum and natural gas.

It might here be pointed out that one circumstance operating in favour of a wider use of coal would also be the adoption of policies consciously aimed at ensuring the most efficient use of each type of fuel. There can be little doubt that much of the currently intense competition between coal, petroleum and natural gas has been fostered by the legitimate desire on part of the operators to expand sales of their respective products by all available means. And while this attitude is part and parcel of normal commercial practice, it may not be in the best long-term interests of Canada as a whole. Fossil fuels are, after all, a wasting asset.

One factor that frequently tends to intrude itself into discussions relating to the future of fossil fuels is the role of nuclear energy in the years to come. But during the forecast period of this Report, this is not likely to be a major factor in Alberta. The recent 'Conference on Peaceful Uses of Atomic Energy' (Geneva, 1955) has provided indications that generating costs between 6 and 10 mills per kWh are either already attainable in nuclear reactors or being rapidly approached. On the other hand, a paper by J. Davis and W. B. Lewis to that conference* stated that in a region in which cheap alternative fuel supplies are available, nuclear energy may have to be generated at (or even below) 5 mills per kWh and that it will require a minimum of 10 years' operation under normal industrial conditions to ascertain whether a reduction of generating costs to such a level is at all feasible. It is worth noting here that costs entailed in the generation of nuclear energy in fission-type reactors are almost wholly made up of fixed charges. Reduc-

*A.E.C.L. Paper No. 20, 1955.

tions in the cost of competitive fuels (accruing, for example, from improved winning and utilization techniques) must therefore also operate against nuclear energy.

That nuclear energy is not likely to be introduced into Alberta during the next 25 or 30 years is moreover further suggested by the distribution of population within the Province—by the growing tendency towards urbanization and by the fact that the more densely settled regions of Alberta are virtually certain to remain adequately supplied with cheap fossil fuels as a direct result of present Government policy relating to conservation of petroleum and natural gas.

Unless the immediate future demonstrates the possibility of obtaining nuclear energy by fusion rather than by fission, it appears therefore highly probable that the general energy production in Alberta will continue to depend upon fossil fuels and hydro-electric power.

2. SUMMARY AND CONCLUSIONS

**R. M. Elofson,
Senior Research Chemist, Coal,
Research Council of Alberta.**

Summary and Conclusions

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2. SUMMARY AND CONCLUSIONS

Reserves of Energy Source Materials in Alberta

Alberta has truly immense and valuable reserves of energy source materials. Fossil fuels include coal, crude petroleum and condensate, natural gas and liquified petroleum gases and the Athabasca oil sand deposit. In addition, there are a number of potential hydro sites on rivers in the Province, and there are deposits of uranium and possibly other nuclear source materials in areas around Lake Athabasca and in the Northwest Territories adjacent to Alberta.

The reserves of coal have been estimated at 48 billion tons of mineable coal, or approximately 48 per cent of Canada's total coal reserve. The above estimate is likely to be revised upwards since seismic surveys made in connection with petroleum and natural gas exploration revealed coal seams in areas not known previously to contain coal and have indicated a greater number of seams in areas already prospected. The coals of Alberta range in rank from lignite to semi-anthracite and are suitable for the generation of electrical energy, for space and process heating, for railway locomotives, and for the production of chemicals, synthetic liquid fuels and high B.t.u. gas.

The net proven reserves of crude petroleum and condensate have been given by the Petroleum and Natural Gas Conservation Board at approximately 2.2 billion barrels for 1954. An approximate estimate of the total petroleum and natural gas reserves which have accumulated beneath Alberta may be derived by calculating the total volume of favourable sediments underlying the province, and assigning to this volume an average unit accumulation factor, calculated, in units of hydrocarbons per cubic mile of sediments, for a comparable basin which has been extensively developed. If the minimum accumulation factor, based on the total reserves presently discovered in the United States, is applied to the volume of favourable sediments underlying Alberta, a total potential reserve of 10.8 billion barrels of recoverable crude petroleum is calculated for Alberta. This reserve may be increased to a total of nearly 14.9 billion barrels if the ultimate accumulation factor estimated for the United States is applied to the sediments of Alberta. Assuming total virgin recoverable reserves of crude petroleum and condensate to be 12 billion barrels, and cumulative production, to 1980, of 7.8 billion barrels, this would leave a net recoverable reserve of crude petroleum and condensate at 1980 of 4.2 billion barrels.

Estimates compiled by the Petroleum and Natural Gas Conservation Board indicate that as at July 1, 1955, the Province possessed approximately 15.6 trillion cubic feet of net disposable natural gas reserve. The Board's opinion, which is believed to be conservative, places total initial disposable reserves of natural gas at approximately 60 trillion cubic feet, with net reserves in 1980, after allowing for production in the order of 25 trillion cubic feet, at approximately 35 trillion cubic feet.

Reserves of recoverable liquified petroleum gases and natural gasoline are estimated to be in the order of 341.4 million barrels as of September 1955. It is anticipated that future development and production reserves of liquified petroleum gases and natural gasolines will parallel the development forecast for crude petroleum and natural gas. This contention is readily understood when consideration is given to the expected volumes of con-

served oilfield gas and the fact that future export gas will be processed for the extraction of the liquid hydrocarbons.

In addition to reserves of crude petroleum, Alberta has enormous potential reserves of oil in the Athabasca oil sand deposits. There have been many estimates with respect to the amount of oil that these deposits contain but a conservative estimate would be in the order of one hundred billion barrels. The estimate of potential hydro-power development possible in Alberta, based on modern concepts of production, is 2.85 million K.W. This represents 600,000 K.W. generating capacity on investigated sites on the Bow and North Saskatchewan rivers, and 2.25 million K.W. from partially investigated sites on the North Saskatchewan, Athabasca, Peace and Slave rivers.

Alberta has no proven deposits of nuclear energy source materials, but there are large deposits of uranium in the neighbourhood of Lake Athabasca in Saskatchewan, and in the Northwest Territories adjacent to the northern boundary of Alberta.

Production of Energy Sources in Alberta

The projected production figures for each of the energy sources of Alberta on the basis of equivalent B.t.u.'s are shown in Figure 1. The projection indicates that the production of energy source materials in Alberta will increase five-fold by 1980 and that it will be dominated by crude oil and natural gas. Production of each of these materials will increase rapidly and should account for about 50% and 40% respectively of the total production of energy source material by 1980. These percentages correspond to annual production figures of 350-400 million barrels crude oil and 1200-1600 billion cu. ft. of natural gas. The large production of natural gas and crude petroleum will also result in an additional energy supply in the form of liquified petroleum gases (L.P.G.) and natural gasoline. By 1980 about 2.5 per cent of the energy source materials produced (or 119 trillion B.T.U.) will be available from this source. The discovery and development of crude oil and natural gas reserves will be adequate to maintain these production rates.

It is anticipated that the production of coal in Alberta will continue its downward course for about five more years. But by 1985 power generation is expected to consume 3-4 million tons of coal per year to produce about 40% of Alberta's electrical requirements, and an approximately equal tonnage is anticipated to be used for the provision of process heating. By 1985, the total output of coal should therefore have recovered to a figure of some eight million tons per year. The presently indicated minimum reserves of coal, 48 billion tons, are so huge that coal production cannot effectively diminish the supply in the foreseeable future.

The production of hydroelectric power in Alberta will just about keep pace with the growth of the power industry until, by 1985, it will produce 40-50% of the annual requirement of 8-9 billion kilowatt hr. This estimate has been converted for the projections of Figure 1 and Figure 2 into the displaced fuel equivalent by multiplication by 14,000 B.t.u. Despite the existence of large potential water power sites, thermal stations may be developed somewhat faster than hydroelectric power because of an abundance of cheap coal.

Consumption of Energy Sources in Alberta

The pattern of energy consumption in Alberta will differ from that of energy production because about 80 per cent of the crude oil and natural gas is expected to be exported. On the other hand, coal may mainly serve nearby markets so that the figures for production and consumption in Alberta will tend to coincide after 1965. Unless there are large-scale industrial developments in the Lake Athabasca region and adjacent areas, there is little likelihood of exporting large quantities of hydroelectric power because the major sources of Alberta's hydroelectric power are remote from potential urban markets outside the Province. Consumption patterns for L.P.G. and natural gasoline in Alberta are difficult to assess. For the purposes of the projections in Figures 1 and 2 it has been assumed that the greater part of these materials will be consumed within the Province both as fuel and chemical raw materials. Alternatives will be briefly discussed later.

The above considerations have been incorporated into the projections shown in Figure 2. Although the projected population increase by 1980 will only amount to about 60 per cent, the overall increase in the consumption of energy source materials is expected to increase five-fold due, largely, to a higher standard of living and increased industrialization. It is worth emphasizing that this estimate provides for expected further improvements in the utilization efficiency of energy source materials. Were no such improvements to occur, the quantities of source materials required to satisfy the anticipated energy demand would be substantially higher than those indicated in Figure 2. By 1980 this relative consumption of crude oil and natural gas within the Province, approximately 35 and 40 per cent respectively, will still be large, but significant contributions will be made by coal (20 per cent) and hydroelectric power (5 per cent). No figures for nuclear energy are included because it is felt that Alberta, because of the ready availability of fossil fuels, will not need significant quantities of nuclear power for twenty, and possibly for thirty, years. Later, as indicated below, the effect of nuclear power may be profound.

Factors Influencing the Validity of Projections

The projection of the production and consumption of the various sources of energy for a period of twenty-five years will be subject to revision. Both on the provincial and world scene, tremendous changes can be expected as the result of economic pressures and technological research. Some of these factors which have resulted in the projections on the one hand, and which may invalidate them on the other, will now be discussed.

(a) Export of Crude Petroleum and Natural Gas

The export of crude petroleum and natural gas will increase because of ready markets for these materials in Eastern Canada and parts of the United States. Since crude petroleum can be transported more cheaply than natural gas, we can expect the former to move further and sooner than the latter to export markets. If it is assumed that the costs of Alberta crude petroleum and natural gas must be competitive in Ontario, the price of crude petroleum in Alberta will continue to exceed that of natural gas on a B.t.u. basis. Similarly, since natural gas can be moved more cheaply than coal, natural gas will tend to move out of Alberta at a higher price per B.t.u. Therefore, when exports of crude petroleum and natural gas assume normal proportions in relation to reserves, coal will become the cheapest

source of energy in Alberta, particularly for the production of electricity. In this application, handling costs of coal can be minimized and the highest efficiencies of coal relative to other fuels can be utilized. Development of water power as a source of electricity will also be accelerated by the trend of rising fuel oil and natural gas prices.

(b) Long distance Transmission of Electricity

The development of means of transmitting electricity long distances without undue losses could affect the energy picture in Alberta profoundly. The first effect would be the immediate attractiveness of the more distant water power sites in Alberta as sources of electrical energy for the populated centres of Alberta. On the other hand, the long distance transmission of electricity would also make it economical to export electrical energy generated from coal. The Pacific Northwest of the United States, where no relief for the chronic shortage of power based on water power is in sight, is undoubtedly the best potential market for electrical energy within reasonable range. This could result in a large-scale development of the coal industry in British Columbia and Southern Alberta where the closest large deposits of coal are located.

(c) Nuclear Energy

It seems likely that for the next quarter of a century the development of nuclear energy will merely keep pace with the increase in demand for electricity without displacing any of the present power sources except in regions where the latter are comparatively expensive. Thus, introduction of nuclear power stations into Alberta should not be anticipated before 1980 because of the relative abundance of the conventional fuels. The possible development of large-scale mining and refining operations associated with nuclear source materials may actually increase the demand for Alberta's conventional energy source materials. However, nuclear energy developed in other regions may possibly affect certain export markets for Alberta's conventional energy resources.

It may be anticipated that technological advances will be made in the controlled release of fusion energy so that truly enormous supplies of energy may eventually become available. This is not likely to happen within the forecast period of this submission. But research and development on nuclear fusion could give rise to increased demands upon Alberta's conventional energy sources even before 1985.

If and when nuclear energy displaces the fossil fuels as prime energy sources, the latter must be considered valuable reserves of raw materials for the production of chemicals and related products. Unlimited power supplies from nuclear energy may be accompanied by a corresponding increase in the demand for chemical raw materials derived from coal, petroleum and natural gas.

(d) Petrochemicals

The petrochemical industry is virtually certain to become a large market for a number of petroleum products and natural gas in Alberta and may account for up to 20 per cent of the local consumption of natural gas and natural gas liquids. Even if the demands of export markets eventually lead to an increase in price great enough to affect the economics of petro-

chemical utilization of these materials, the industry can adjust itself to the new conditions. Certain operations, such as synthetic ammonia which use large quantities of natural gas to produce relatively low priced commodities, could be converted to coal. Coal could also be used as a source of process heat for other branches of the petrochemical industry which would still use petroleum products as raw materials.

(e) Liquified Petroleum Gases

The utilization of the large quantities of liquified petroleum gases that will become available presents a challenge and an opportunity for the industry of Alberta. The local rural market for propane can only absorb a part of the projected production. Considerable quantities can be utilized as a chemical raw material but additional markets may have to be found outside the Province.

(f) Alternative Sources of Liquid and Gaseous Fuels

As already indicated, Alberta's proven and possible reserves of crude petroleum and natural gas appear quite adequate to sustain very high production rates for many years. However, several circumstances may combine to focus attention upon alternative (or supplementary) sources of liquid and gaseous fuels well before the end of the next quarter century. Some time after 1975—or even before that date in the event of an intervening international emergency—the prevailing demand may cause serious consideration to be given to the exploitation of Alberta's oil sands; and similar consideration may have to be given then (or later) also to the possibility of producing synthetic liquid fuels from coal by hydrogenation. Both processes, i.e. extraction of oil from the oil sands and coal hydrogenation, are currently unable to compete with natural petroleum and gas, but the existing differential would appear small enough to be remedied by future market changes and technological developments.

Coal gasification, a procedure not unlike hydrogenation, may also afford a means of meeting demands for gaseous fuels when supplies of natural gas dwindle or requirements exceed current expectations.

(g) Chemicals from Coal

A chemical industry based on coal as a raw material will have to be integrated closely with the overall industrial development of Alberta. The production of low temperature tar might coincide with the demands of the growing electric power industry for a cheap fuel such as low temperature char, if a regional market can be found for the tar. An indigenous steel industry could lead to a high temperature coal tar industry. Large industrial markets within Alberta and neighbouring areas may lead to the production of a number of chemical specialties from coal.

What must, however, be emphasized is that most of these possibilities (and others that may be envisaged for Alberta on the basis of her enormous fuel reserves) depend closely upon active prosecution of fundamental and applied research. The need is, without question, for more rather than less experimental investigation. This statement applies perhaps most strongly to the case of coal and natural gasoline for which novel outlets must be sought now. But it applies, in the long run, with equal force to all Alberta's fossil fuels. The potential wealth in these materials is far too great to allow them merely to satisfy a temporary need and to leave them untapped when existing market conditions change.

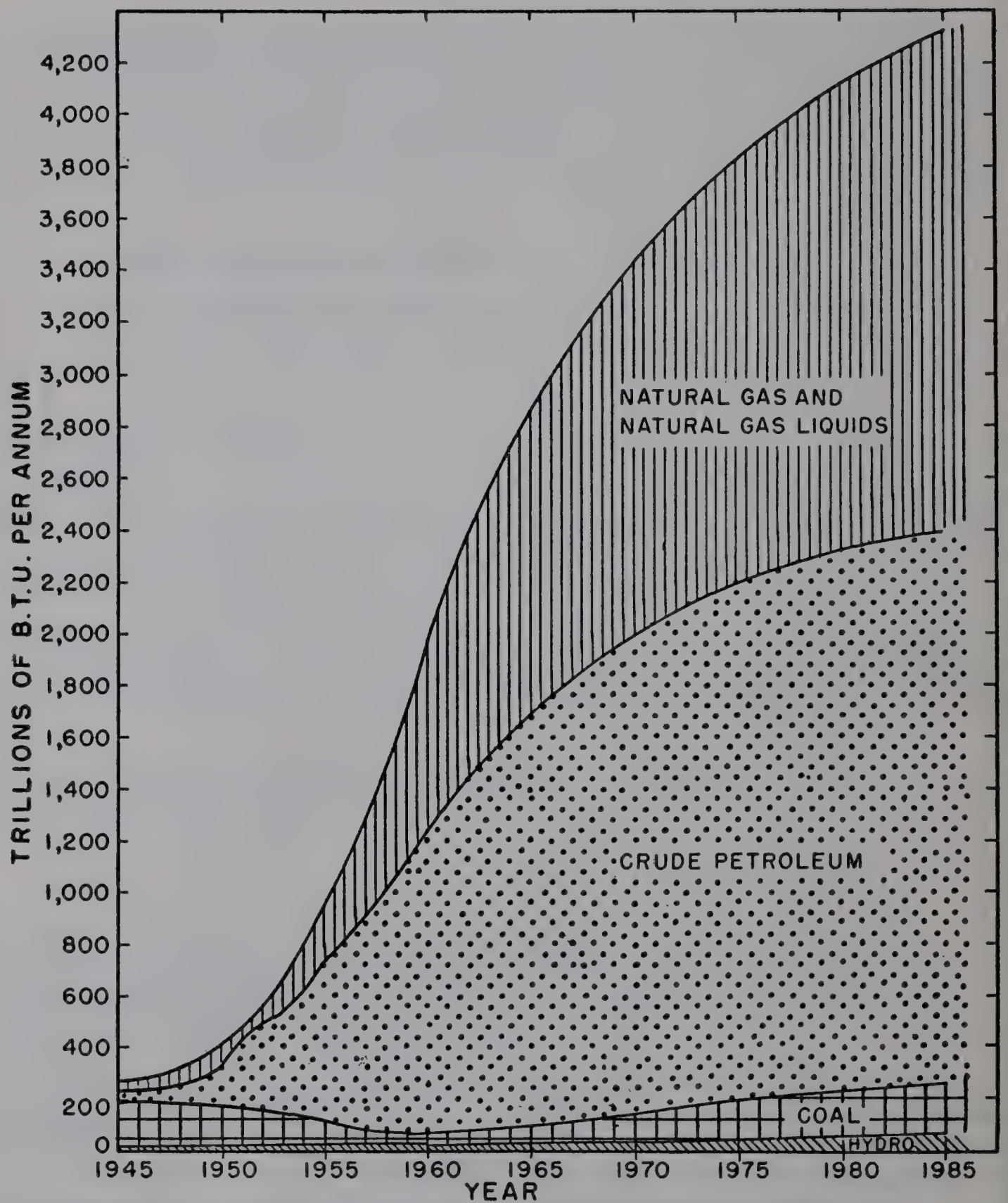


FIGURE.1 OUTPUT OF ENERGY SOURCES FOR ALBERTA

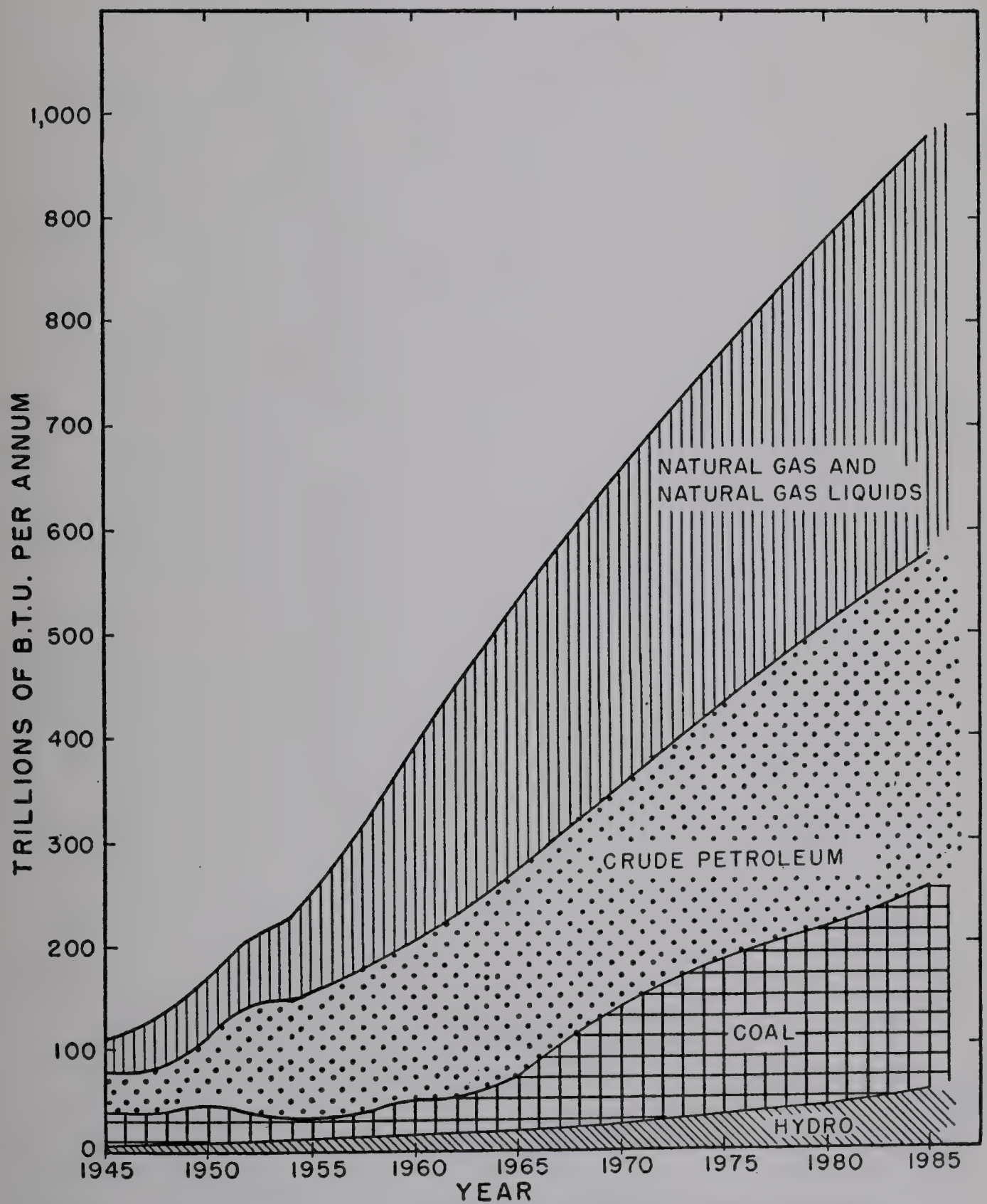
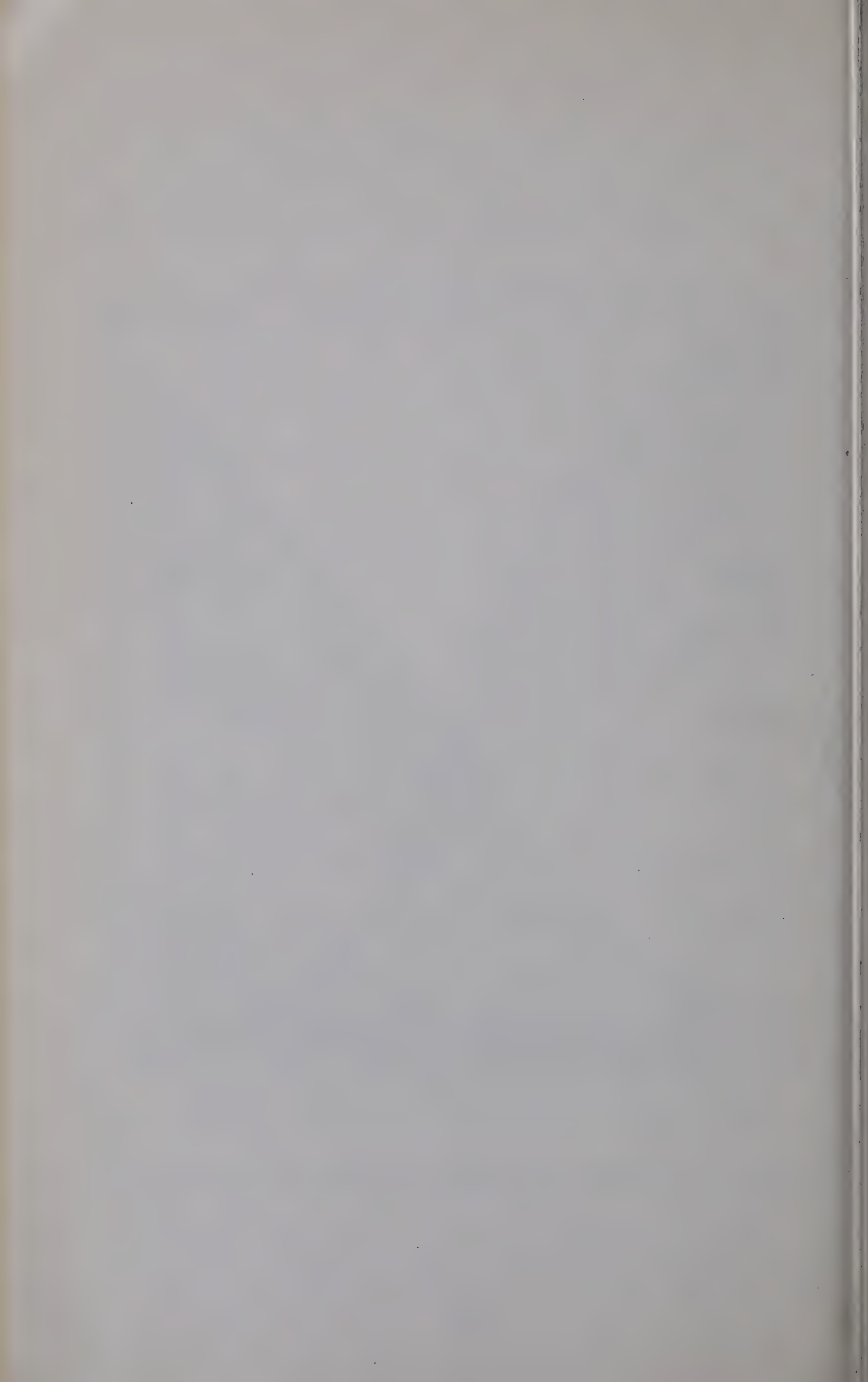


FIGURE.2 CONSUMPTION OF ENERGY SOURCES FOR ALBERTA



3. COAL

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and

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COAL

C O N T E N T S

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3. COAL

Summary

Alberta's reserves of "mineable" coal have been estimated at 48 thousand million net tons, approximately 48 per cent of Canada's total coal reserves. This estimate is based on seams three feet or more in thickness and with less than 2500 feet of cover for bituminous coals, and seams of 3 feet or more in thickness and less than 1000 feet of cover for subbituminous coals. Seismic surveys in connection with oil and gas exploration have revealed large coal seams in areas not previously known to contain coal and a greater number of seams in areas already prospected.

The coal-bearing formations are geologically young—being of Cretaceous age—but the coals in them have been matured by the upthrust of the Rocky Mountains after deposition. They range in rank from lignite to semi-anthracite. Included are large deposits of low and medium volatile coking bituminous coals suitable for the production of metallurgical coke.

Production of coal in Alberta between 1905 and 1954 amounted to approximately 275 million net tons valued at nearly a billion dollars. This production represents less than 0.6 per cent of the estimated mineable reserves. During the last few years production has dropped rapidly due, in large measure, to changes in the railways' policy with respect to fuels and equipment, and to a lesser extent to competition from oil and natural gas in industrial and domestic heating and for power generation. Labour and transportation are major items of cost in respect to coal.

The future of Alberta's coal industry is impossible to predict with any assurance. A further decline would appear likely in the immediate future but the consensus is that, on a long-term basis, the future of the industry is assured. This judgment is based on: immensity of reserves; expanding demands for all forms of energy; technological improvements in the mining; preparation and utilization of coal; an aggressive research program; and predicted increased well-head prices for both oil and natural gas. This has been the pattern of events in the United States and will no doubt be the pattern in Canada and particularly in Alberta.

A number of tables and figures, providing data with respect to the coal industry in Alberta are included as an appendix to this section of "Energy Resources of Alberta".

Geology

Coal-bearing formations underlie most of the southern half of the Province of Alberta. They occur in the plains, foothills and mountains. The coals in these formations are geologically young—mainly of Cretaceous age—but the upthrust of the Rocky Mountains, after the deposition of the coal beds, played an important part in the maturation of the coal, especially of the coals occurring in the foothills and mountains. It is not surprising, therefore, that there is a direct relationship between the location at which a coal occurs and its rank, physical characteristics and chemical composition.

The oldest coal-bearing rocks are of Lower Cretaceous age. They occur in the western or inner belt of the Rocky Mountain foothills and contain the most important deposits of bituminous coal. Coals of Upper Cretaceous age underlie a large portion of the southern part of the Province and outcrop along the outer foothill belt of the mountains and over much of the

central plains. The youngest coal deposits are of Tertiary age. They underlie a small area in the Cypress Hills in the southeastern part of the Province and are also believed to form coal-bearing measures which occur in the outer foothills of central Alberta.

The geology of the coal deposits is given in detail in various reports of the Geological Survey of Canada, and of the Research Council of Alberta. A geological map, compiled by Dr. John A. Allan, showing in colours the coal-bearing formations, was included in the "Province of Alberta Submission on the Coal Resources and Coal Industry of Alberta" that was prepared for the Royal Commission on Coal, April 1945. A similar map prepared by Dr. B. R. MacKay is given in Chapter 1 of the "Report of the Royal Commission on Coal, 1946".

A summary of the geology of the coals of Alberta, which includes horizon, number and thickness of seams, depth and nature of overburden and other pertinent data, was published by the Research Council of Alberta as Report No. 34, Part V, 1943, "Geology, Coal Areas of Alberta". A companion volume, "Coals of Alberta—Their Occurrence, Analysis and Utilization", Research Council Report No. 35, 1944, gives detailed data relative to classification, physical and chemical properties and utilization of Alberta coals.

For convenience in compiling data and ease of reference, the parts of the Province in which coal has been mined have been divided into "coal areas". The boundaries of these areas were designed to conform to the boundaries of the geological formations in which deposits of coal of similar age and with similar physical and chemical characteristics occurred. There are at present fifty coal areas. These are shown in "Coal Areas of Alberta Key Map, 1944" which is included in the Appendix as Figure 1. Coal statistics published by both the Federal and the Alberta governments are arranged according to the coal areas as named on this map.

Classification of Alberta Coals

Under the classification developed by the American Society for Testing Materials (Designation D.388-38), which Canada has adopted for classifying its coals, the coals of Alberta range in rank from lignite to semi-anthracite. This classification is complicated for the layman, and in order to give a simple, easy to remember scheme, and one suitable for use in coal sales, the Research Council of Alberta developed a "group" classification for Alberta coals which is as follows:

Group Classification for Alberta Coals

Group 1

Low volatile, non-caking bituminous coals from mountain areas.

Canadian Classification: Low volatile bituminous, and some semi-anthracite.

Important Areas: Cascade, Nordegg. If the Highwood area is developed, it will be included in this group.

Characteristics: A good storage, weather-resistant coal. Burns with a short, slightly smoky flame. Used for domestic heating, railway fuel and for steam raising in general. Briquettes produced from the coal are used for domestic heating and as a locomotive fuel.

Output: Total for group 353,540 tons in 1954; one coal cleaning and one briquetting plant is now operated.

Range of Typical Analyses: Moisture 1 - 2%, ash 8 - 10%, volatile matter 10 - 16%, fixed carbon 73 - 80%, heat value 14,000 to 14,200 B.t.u. per pound.

Group 2

Medium and high volatile coking bituminous coals from mountain areas.

Canadian classification: Medium volatile and high volatile A and B bituminous coal.

Important Areas: Crowsnest, Mountain Park.

Characteristics: A good storage, weather-resistant coal. Burns with a medium to long, smoky flame. Used for domestic heating, for locomotive fuel and for steam raising in general. Also used for making coke, as smithy coal and in the cement industry.

Output: Total for group 1,351,322 tons in 1954; two briquetting and four cleaning plants are operated.

Range of Typical Analyses: Moisture 1 - 4%, ash 8 - 15%; volatile matter 20 - 36%, fixed carbon 46 - 65%, heat value 12,000 to 13,500 B.t.u. per pound.

Group 3

Subbituminous coals, principally from the foothills areas.

Canadian Classification: Non-caking high volatile C bituminous.

Important Areas: Coalspur, Lethbridge, Prairie Creek, Saunders.

Characteristics: A good storage, weather-resistant coal. It is a reactive non-caking coal that burns with a long, slightly smoky flame. Used for domestic heating and for steam raising purposes. It is a strong coal and can be shipped and stored well.

Output: Total for group 697,323 tons in 1954. Three coal cleaning plants are operated.

Range of Typical Analyses: Moisture 7 - 12%, ash 7 - 13%, volatile matter 32 - 35%, fixed carbon 41 - 50%, heat value 10,400 to 11,900 B.t.u. per pound.

Group 4

Domestic Coals—fair storage coal from prairie areas.

Canadian Classification: Subbituminous A, B and C.

Important Areas: Brooks, Big Valley, Carbon, Drumheller, Edmonton, Pembina, Taber.

Characteristics: Can be stored under cover. It is a reactive non-caking coal that ignites easily and burns with a long, smokeless flame. Used for domestic heating and also for steam raising in boilers with liberal furnace and grate dimensions. Usually shipped in box cars.

Output: Total for group 1,785,747 tons in 1954. One coal cleaning plant in operation.

Range of Typical Analyses: Moisture 16 - 25%, ash 6 - 12%, volatile matter 26 - 32%, fixed carbon 38 - 45%, heat value 8,500 to 10,000 B.t.u. per pound.

Group 5

Domestic Coals—fair storage under cover, from prairie areas.

Canadian Classification: Subbituminous B and C.

Important Areas: Camrose, Castor, Sheerness, Tofield.

Characteristics: Does not store as well as previous groups. It is a reactive, non-caking coal that ignites easily and burns with a long, smokeless flame. Used for domestic heating and for steam raising in boilers with liberal furnace and grate dimensions. It is shipped in box cars.

Output: Total for group 671,204 tons in 1954.

Range of Typical Analyses: Moisture 24 - 30%, ash 5 - 9%, volatile matter 27 - 30%, fixed carbon 35 - 40%, heat value 7,700 to 9,000 B.t.u. per pound.

Reserves of Coal

It will be readily apparent that an estimate of the coal reserves of any area will depend largely upon the yardstick which is employed to measure these reserves. The amount arrived at will be influenced by the completeness of the data with respect to the areal extent of the coal-bearing formations, the thickness and uniformity of the seam or seams and the depth of overburden.

A detailed study of the coal reserves of Canada was made at the time of the Royal Commission on Coal. The results of that study are included in

Chapter 1 and Appendix A of the Commission report. Table 1 (see Appendix), taken from this report, gives by provinces the estimated reserves of Canadian coal.

In this estimate a distinction is made between "mineable" coal and "recoverable" coal. Mineable coal refers to coal which is considered to exist in mineable thickness within a required distance from the surface. However, it is unusual to recover even approximately 100 per cent of this coal. The degree of extraction varies greatly according to local conditions, both in respect to mining and market conditions. The Royal Commission in its report assumed "recoverable" reserves as 50 per cent of "mineable" reserves, in other words it assumed 50 per cent extraction.

Further terms used by the Commission were "probable" and "possible" reserves. Probable reserves include coal which, by direct mining experience and by drilling, continuity to existing workings and areas drilled, or extensive geological data, can be reasonably expected to exist. Possible reserves are additional to probable reserves and include coal, the reasonable existence of which is based on limited geological data and prospecting, and coal the recovery of which is problematical due to its inferior quality and/or relative inaccessibility.

The estimate for Alberta bituminous coals is based on seams 3 feet or more in thickness to a maximum depth of 2500 feet. The subbituminous coals are estimated on the basis of seams 3 feet or more in thickness with not more than 1000 feet of cover.

The Commission report states: "It is likely that greater knowledge of Canadian reserves will extend rather than contract the present estimate." This would appear to be the case in Alberta as seismic surveys made in connection with exploration for oil and natural gas have not only revealed coals seams in areas not known previously to contain coal but have also indicated a greater number of seams in areas already prospected.

It will be noted in Table 1 (see Appendix) that Canada is estimated to have about 99 thousand million net tons of mineable coal or some 49 thousand million net tons of recoverable coal. Alberta, according to the estimate, has approximately 48 thousand million net tons of mineable coal or 48 per cent of Canada's total reserves of coal. A breakdown of Alberta's reserves by groups is given in Table 2 (see Appendix) compiled from other data in the Commission Report. This information was used to compute the total energy contents of Alberta's coal reserves in trillion B.t.u. (see Table 3, in Appendix).

Mining Methods

Coal in Alberta is recoverable by both underground and strip mining. A room-and-pillar system is used in some underground mines, while in others the long-wall system of mining is employed. Many of the mines are highly mechanized and have well-designed tipplers and preparation plants. Stripping operations have increased markedly in recent years, largely due to the lower costs of strip mining especially where the coal lies close to the surface. The recovery per man-hour depends on mining conditions, size of mine, and whether strip or underground operations are employed. For the better mines it is comparable with recovery per man-hour elsewhere in America.

Production

Production of coal in Alberta between 1905 and 1954 amounted to approximately 275 million tons and was valued at nearly a billion dollars. This production represents less than 0.6 per cent of the estimated mineable reserves of coal in Alberta, and just over one per cent of Alberta's estimated recoverable coal. The immensity of Alberta's coal reserves can be appreciated when it is realized that on the basis of 10 million tons per year output this reserve would last for over 2,000 years.

The pattern of coal production in Alberta, both in tonnage and in value, is shown in Figure 2. It was plotted from data contained in the "Annual Reports of the Mines Division of the Department of Mines and Minerals of the Province of Alberta".

This figure reflects the history and economy of the Province and the Nation—the early years of development, the rising production and prices of World War I, the post-war years, the depression of the thirties, the rising production and prices of World War II, the competition from oil and natural gas and finally dieselization of the railways.

The production by groups for the ten year period 1944 to 1954 is given in Table 4 (see Appendix). It will be noted that the production for groups 1 to 3 dropped appreciably between 1952 and 1954, whereas groups 4 and 5 maintained their production.

Preparation and Processing

Coal, as mined, is not uniform in quality throughout: pieces of floor, of roof or of partings may be included with the coal, often firmly attached to clean coal. Because uniformity of the product is essential to good marketing and satisfied customers, most of the larger collieries in Alberta have preparation plans in which the product to be sold is cleaned to a uniform ash content and, if wet-washed, dried to a defined moisture content. Screening facilities are also included in the preparation plants to separate the coal into the various sizes required for marketing.

The Mines Branch of the Department of Mines and Minerals of Alberta have established coal sales regulations under the "Coal Sales Act". These regulations include the methods to be used for the sampling and analysis of commercial coals, and specifications with respect to the size grading of Alberta coals that are marketed.

Alberta coals of groups 1 and 2 are inherently friable and contain a high percentage of fines. Objection was taken by the railways to the percentage of fines in the slack coal purchased because, it was claimed, these fines caused high stack loss in locomotive operation. This forced coal operators producing these coals to build briquetting plants. Five such plants, having a total capacity of over 5,000 tons per day, have operated for a number of years. These plants also produced briquettes for the domestic market. Briquettes made for sale to the railways contain 3 - 4 per cent of an asphalt binder, and those made for the domestic market 7-8 per cent of asphalt binder. The annual production of briquettes from 1944 to 1954 is given in Table 5 (see Appendix).

Alberta has large reserves of low and medium volatile coking bituminous coals suitable for the production of coke. These coals are low in sulphur, a desirable feature for metallurgical coke. For many years, beehive coke ovens were used at mines in the Crowsnest Pass area, but these have

ceased operation. In recent years, interest has been shown in Alberta's reserves of coking bituminous coals by several industrial concerns, with consideration being given not only to the feasibility of building a modern coke plant in Alberta, but also to the possibilities of exporting low and medium volatile coking coals to the northwestern United States to be used for blending with high volatile coking coals. The development of a steel industry in Western Canada would provide a market for substantial quantities of coke.

Markets

Markets, rather than reserves or productive capacity, are the major problem of the Alberta coal industry. A stable industry can be maintained only if there is an assured market for a reasonable tonnage on a continuing basis. The fact that Alberta's coal fields are distant from the main centres of population in Canada—Ontario and Quebec—has militated against Alberta coals in these areas, largely because of transportation costs. Competition from oil and natural gas in Alberta has also reduced the outlet for coal for space heating and power generation. However, the most serious blow to the coal industry was conversion of many coal burning locomotives to heavy oils followed by dieselization of the railways.

The disposition of Alberta coal during the period 1944 to 1954 is shown in Figure 3. (see Appendix). The amount of coal used in making briquettes, which were subsequently sold either to the railways or to domestic consumers, is not shown, but Table 5 (see Appendix) gives the production of briquettes during this period.

It will be noted that until 1954 the Railways have been the largest single consumer of Alberta coal. It represented approximately 30 per cent of the total output. In past years 65 to 85 per cent of the output from the bituminous mines in the northern section of the mountain belt was sold as railway fuel. The change in railway fuel policy, first to use heavy oils in coal-burning locomotives and latterly conversion to diesel locomotives, has forced the complete closure of three large mines in this part of the Province and reduced operations at two more, thereby resulting in an overall loss of 1.7 million tons annually. While only one closure has taken place to date in the Crowsnest Pass areas of Alberta and British Columbia, the loss of railway tonnage alone has amounted to over 800 thousand tons per annum. The building of a natural gas pipeline to the west coast no doubt will further reduce the markets for this type of coal, since considerable quantities of it are now used for industrial heating and for the production of coal gas by the B.C. Electric Co.

It seems likely that a number of the larger strip mines producing Groups 4 and 5 coals will increase their present output in the years ahead, especially when thermal power plants are built at or near mine sites. These mines have large reserves of cheaply mined coal and the price of the finer sizes of the product are even now competitive with natural gas when there is a market for the lump coal. When the output of these mines is increased, larger and more efficient stripping equipment will be installed which will reduce the overall production costs of the total output and make the products still more competitive with other fuels.

The prairie underground mines producing Group 4 coals, which have dominated the western domestic market for years, are now having a difficult time because of competition from strip coal, natural gas and propane. While there continues to be a reasonable demand for the lump and egg sizes of these coals, particularly in rural areas, the market for 2-inch coal has de-

creased very materially and in order to dispose of this size, it has had to be sold at a lower than normal price. This poses a serious problem in the overall realization for the total mine output. Since the Group 4 underground mines are costly to operate, something will have to be done, either by reducing costs of operation or by higher returns for the product; otherwise these mines will be forced to close, with the consequent abandonment of large areas of developed coal.

Group 3 bituminous C coals are of the non-caking domestic type. They are produced partly by underground mining and partly by stripping operations from pitching seams in the foothills areas. A large part of the strip coal has until recently been sold to the railways but this market has disappeared. The lump coals of Group 3 are a premium domestic fuel and have found a ready market in British Columbia. This market will be jeopardized when natural gas pipelines reach the coast area.

The present trend of markets for Alberta coal is downward and it seems likely that this will continue until such times as oil and natural gas are sold at realistic prices for industrial heating and for power generation, or until new markets for coal are developed through minehead power generation, liquification, gasification or chemical utilization.

Financial Aspects

Capital investment in the Alberta Coal Industry has been variously given at between \$30 and \$40 million. However, the recent closing of a number of mines will materially reduce these figures. Furthermore, disposal of the physical assets of closed mines will realize only a fraction of their value.

Operating costs and revenues per net tons of marketable coal produced in Alberta for 1952, a typical year, are given in Table 6 (see Appendix). These have been taken from the Annual Report of the Dominion Coal Board for 1953-1954, pp. 42-43.

Because of differences in operational costs under different conditions of mining, the data are given under the headings of "Alberta Prairie", "Alberta Foothills" and "Alberta Mountain". It will be noted that labour is the largest single item of production costs amounting to approximately 50 per cent of the total. Table 7 (see Appendix) gives the labour statistics for the coal mines of Alberta between 1944 and 1954.

Each of the studies made of Alberta's coal industry during the last 30 years has considered the barrier of distance between the mines in Alberta and the large potential markets in Central Canada, and each has recommended that this handicap be overcome by assistance in the shape of reduced freight rates; by railway cooperation; and contributions towards payment of freight charges by Dominion government subvention. Table 8 (see Appendix) shows the subvention rates for coal mined in Alberta and the Crowsnest Pass area of B.C., as authorized by P.C. 1954 - 688 passed May 6, 1954.

These regulations were changed in March 1955 as follows.

(a) The flat rate of \$3.50 per ton on industrial coal to Ontario was increased to a maximum of \$4.00 as a difference in laid down costs:

(b) A new subvention of up to \$1.00 per ton as a difference in laid down cost was granted on industrial coal to Manitoba:

(c) Subvention on coals for other than industrial use was increased:

- (1) Where the freight rate is in excess of \$9.00 per ton but less than \$10.75 per ton—from \$3.00 per ton to \$3.50 per ton;
- (2) Where the freight rate is \$10.75 per ton or in excess thereof from \$3.50 per ton to \$4.00 per ton.

The subsistence rates paid by the Federal Government to Railways for the assistance of Alberta coal to markets between 1944 and 1954 are given in Table 9 (see Appendix).

The Outlook for Coal

Despite the seriousness of the situation that currently faces the Alberta coal industry, there are several reasons for anticipating a definite reversal of present trends in the years ahead. In the immediate future, a significant improvement is perhaps only likely as a result of deliberate Government policy. The competitive position of coal in relation to other fuels would, for example, be greatly strengthened if a national energy policy were to be formulated and implemented, or if Government aid were to be extended to the industry in order to maintain it against the event of a national or international emergency. It is of some importance to remember that coal is, beyond doubt, the most stable energy resource in such an emergency, and that coal supplies are less liable to disruption by enemy action than those of other fuels.

Without Government intervention, present problems are likely to be aggravated for some time. With the extension of pipelines for petroleum and natural gas transport to markets outside Alberta, coal will in all probability be displaced from parts of its present British Columbia and Saskatchewan markets; and coal sales to such domestic consumers as remain in Alberta are likely to be further curtailed. However, on a longer term view, there remains the unquestionable fact that coal represents not only Alberta's largest and potentially cheapest energy resource, but that it is also the fuel most likely to profit from technological advances and improvements in mining and utilization techniques. Even at present, the price differential between coal, petroleum and natural gas is extremely small. Were the price of petroleum and gas to rise as a consequence of the development of more remunerative export markets, or that of coal to fall somewhat as a result of reduced mining and handling costs, a pronounced upsurge in the demand for coal in Alberta is inescapable.

The extent of the eventual recovery of the Alberta coal industry that can be foreseen at this stage is necessarily uncertain. However, a reasonable estimate of future production may be obtained by considering (a) probable and (b) possible developments in Alberta.

Probable coal developments may be assumed to be determined in the main by Alberta's requirements of electrical power and by certain other firm industrial demands. As suggested in Section 6 of this Report, power generation within the Province is likely to become overwhelmingly dominated by water power and coal, with some 42% generated in thermal stations burning coal. By 1985 the annual consumption of coal for this purpose may therefore reach between 3 and 4 million tons. The lower figure would be operative if internal demand only is to be met, and the higher if, in addition to internal demand, coal-burning plants were to be used to

supply electrical power for consumption in the Pacific northwest States. This latter development is likely to become economically attractive as a result of improvements in combustion equipment and combustion efficiency, and it is technically feasible because of the proximity of the Crownsnest Pass coal formations to the major population centres of Idaho, Washington and Oregon.

A perhaps equally extensive market for coal is likely to offer itself by industry other than power-generation, particularly if coal's competitive position in relation to petroleum and natural gas improves as a result of changes in the price structure currently obtaining among fossil fuels. Here again, justifiably expected advances in combustion engineering may play a decisive role. To assume an annual requirement of 3 - 4 million tons for the provision of industrial heat is by no means unreasonable, especially when it is borne in mind that much of the existing industrial market other than railroads has been lost to coal not because coal proved inferior to petroleum and natural gas but because there does not seem to have been an effective coal sales and servicing program. There are indications that Alberta coal operators have become aware of this shortcoming and that they are now trying to remedy it.

The probable course of events is therefore (a) some further decline of coal production in the immediate and very near future, and (b) from about 1960 on, a recovery and eventual stabilization of the industry at an annual production of between 6 - 8 million tons. This figure would constitute a 'base level', but would be adequate to permit economic operation of the Alberta coal industry.

Possible developments that would strengthen the industry may arise partly from continued industrial expansion in the Province and partly from the successful conclusion of currently promising lines of fundamental and technological research. Certain of these developments would, incidentally, also tend to improve the economics of power-generation from coal. A few examples may help to illustrate these points:

1. If presently-discussed plans for the establishment of an iron and steel industry in Alberta come to fruition, considerable tonnages of coal would be required for carbonization and the provision of metallurgical coke. Recovery and sale of the by-products of such an operation would provide additional revenue.

2. Coal's suitability for the generation of heat and power would be greatly enhanced by foreseeable advances in combustion engineering. During the past few years, it has been shown that generating efficiencies can be increased and generating costs reduced by resorting to higher boiler pressures and larger plants; and much progress has also been made in the design of automatic coal handling and metering, in stoker design, and in securing increased combustion efficiencies. Further advances may be expected in the years ahead. Already, they have been responsible for a pronounced 'return to coal' in American power stations. It is, incidentally, quite conceivable that analogous advances in the field of domestic coal-burning equipment may also enable coal to retain and even expand its share of the domestic consumer market. New and improved domestic equipment, ranging in type from small stoves and space heaters to fully automatic domestic stokers, are now offered at a competitive price and may be expected to play an important role especially among rural domestic consumers in areas in which rural electrification has been made available.

3. In view of recent American experience relating to the economics of diesel-operated railroads, there are some reasons for thinking that coal may recapture a substantial share of the railway-fuel market. Such a development would, in fact, become a distinct probability if current work on coal-fired gas turbines is successfully completed. Research on these turbines is at present carried out at McGill University and in the U.S.A. by the Locomotive Development Committee of Bituminous Coal Research, Inc. The Canadian project is largely financed by the Federal Government. Prototype turbines have already been built and operated, and their performance has been favourably reported on.

4. And finally, there appears to lie ahead a distinct possibility of eventually basing a chemical industry on coal that will supplement rather than compete with the petrochemical industry. The possibility of converting coal into synthetic liquid and gaseous fuels by hydrogenation and gasification—processes that have been exhaustively studied in the U.S.A. and in Germany—is considered remote in Alberta unless new developments in this field are reported. But hydrogenation to produce chemicals rather than gasoline, and/or carbonization with subsequent manufacture of organic chemicals from the carbonization by-products, appear quite capable of exploitation in Alberta. What is particularly attractive about these possibilities is that Alberta's diversity of coal types would permit appropriate selection of different coals for specific manufacturing processes. Moreover, in an integrated industry, hydrogenation residues and the carbonized chars obtained from such operations would offer a cheap and desirable fuel for power-generation. Also potentially possible within Alberta is the use of coking coals for the production of so-called 'structural carbons' (such as acid-tank and blast furnace linings, heat exchangers, corrosion-resistant tubes, etc.) by established processes already employed on a fair scale in the U.S.A. and in Britain. The manufacture of chemicals and structural carbons from coal would of course not require very large tonnages of raw coal, but could nevertheless be of tremendous value to Alberta's coal industry.

The examples just given do not by any means exhaust possibilities. Nor ought they be viewed as all being equally likely to play a part in Alberta's economy in the years ahead. But they illustrate what might be done; and they provide sound reasons for optimism about the future of coal in the Province. Were developments such as these to be undertaken, an annual coal production of the order of 9 - 10 million tons, and a very substantial contribution by the coal industry to the value of Alberta's manufactured products, may be looked forward to with confidence.

This confidence is strengthened by the following excerpt from the Dominion Coal Board's Annual Report for 1953-54:

"The Board, from its inception, has worked from the premise that the Canadian coal industry is vital to the economy of the nation. The decline in the industry during the past few years has not affected this opinion but, on the contrary, has strengthened their conviction of the necessity for the industry's preservation. Coal still remains the chief basis of the economy of the main industrial countries of the world."

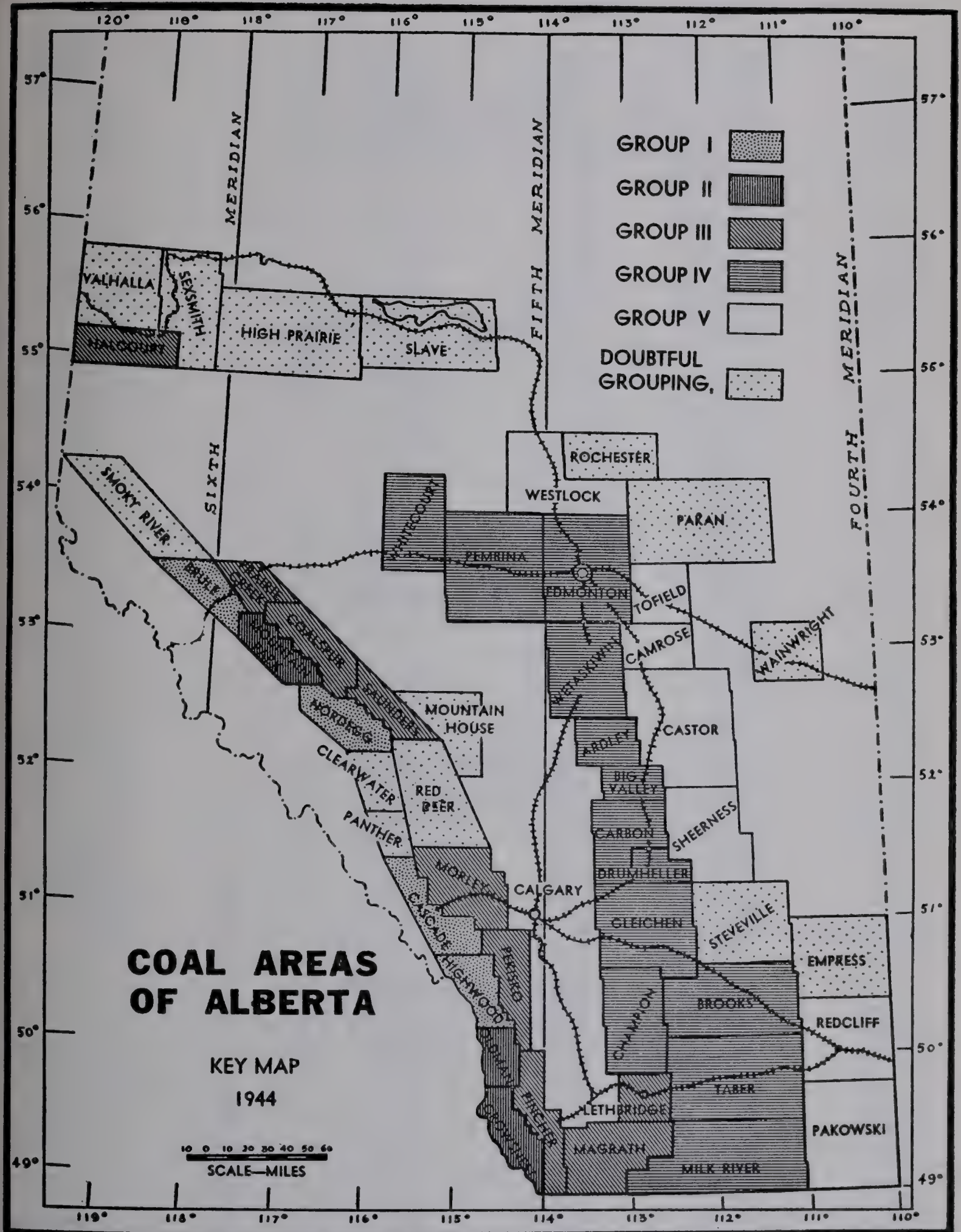


Figure I

TABLE 1.
COAL RESERVES OF CANADA *

Province	Probable	Mineable Coal	Total	Thousands of net tons	Recoverable Coal	Total
		Possible (additional)			Possible (additional)	
Nova Scotia	1,967,024	1,147,382	3,114,406	983,512	573,691	1,557,203
New Brunswick	89,814	11,566	101,380	44,907	5,783	50,690
Ontario	100,000	50,000	150,000	50,000	25,000	75,000
Manitoba	33,600	67,200	100,800	16,800	33,600	50,400
Saskatchewan	13,126,880	11,004,000	24,130,880	6,563,440	5,502,000	12,065,440
Alberta	34,437,630	13,436,560	47,874,300	17,218,870	6,718,280	23,937,150
British Columbia	11,795,480	7,034,556	18,830,036	5,897,740	3,517,278	9,415,018
Yukon	434,560	1,449,840	1,884,400	217,280	724,920	942,200
N. W. T.	140,000	2,489,760	2,629,760	70,000	1,244,880	1,314,880
CANADA	62,000,000	37,000,000	99,000,000	31,000,000	18,000,000	49,000,000

*Report of the Royal Commission on Coal, 1946
chapter 1, p. 11.

TABLE 2.
RESERVES OF ALBERTA COALS BY GROUPS*

Area	Mineable Coal		Recoverable Coal	
	Probable	Possible (additional)	Probable	Possible (additional)
Thousands of Net Tons				
Group 1				
Smoky River	2,250,000	1,349,600	1,120,000	674,800
Brule	761,600	683,200	380,800	341,600
Nordegg	1,892,800	868,000	946,400	434,000
Cascade	2,228,800	660,800	1,114,400	330,400
Highwood	3,762,080	1,684,480	1,881,040	842,240
Totals	10,895,280	5,246,080	5,442,640	2,623,040
Group 2				
Mountain Park	2,816,800	554,400	1,408,400	277,200
Clearwater	224,000	124,320	112,000	62,160
Panther	431,200	128,800	215,600	64,400
Oldman	2,811,200	397,600	1,405,600	198,800
Crowsnest	3,157,280	872,480	1,578,640	436,240
Totals	9,440,480	2,077,600	4,720,240	1,038,800
Group 3				
Halcourt	168,000	84,000	84,000	42,000
Prairie Creek	240,800	173,600	120,400	86,800
Coalspur	3,376,800	576,800	1,688,400	288,400
Saunders	1,275,680	874,720	637,840	437,360
Morley	375,200	554,400	187,600	277,200
Pekisko	728,000	593,600	364,000	296,800
Pincher	156,800	201,600	78,400	100,800
Magrath	437,900	39,200	218,950	19,600
Lethbridge	678,720	144,480	339,360	72,240
Red Deer	420,000	520,800	210,000	260,400
Totals	7,857,900	3,763,200	3,928,950	1,881,600
Group 4				
Milk River	428,960	282,240	214,480	141,120
Taber	408,800	229,600	204,400	114,800
Brooks	182,560	425,600	91,280	212,800
Valhalla	30,240	20,160	15,120	10,080
Pembina	1,260,000	252,000	630,000	126,000
Edmonton	627,200	120,960	313,600	60,480
Ardley	280,000	20,160	140,000	10,080
Big Valley	89,600	44,800	44,800	22,400
Carbon	302,400	50,400	151,200	25,200
Drumheller	994,000	324,800	497,000	162,400
Gleichen	58,800	16,800	29,400	8,400
Champion	67,200	16,800	33,600	8,400
Wetaskiwin	56,000	28,000	28,000	14,000
Whitcourt	84,000	16,800	42,000	8,400
Totals	4,869,760	1,849,120	2,434,880	924,560
Group 5				
Pakowski	254,240	57,120	127,120	28,560
Redcliff	51,520	78,400	25,760	39,200
Steveville	16,800	33,600	8,400	16,800
Empress	20,160	30,240	10,080	15,120
Wainwright	6,720	20,160	3,360	10,080
Pakan	13,440	20,160	6,720	10,080
Rochester	13,440	20,160	6,720	10,080
Sexsmith	16,800	13,440	8,400	6,720
Westlock	26,880	47,040	13,440	23,520
Slave	10,080	16,800	5,040	8,400
High Prairie	15,680	23,520	7,840	11,760
Tofield	246,400	33,600	123,200	16,800
Camrose	112,000	16,800	56,000	8,400
Castor	336,000	26,800	168,000	13,400
Sheerness	235,200	26,880	117,600	13,440
Mountain House	8,960	35,840	4,480	17,920
Totals	1,384,320	500,560	692,160	250,280

*Compiled from data in Report of the Royal Commission on Coal, 1946.

TABLE 3.
RESERVES OF MINEABLE COAL IN ALBERTA IN TRILLION B.T.U.

Group	Mineable Coal in Thousands of Net Tons	Assumed B.t.u./lb.	Trillion B.t.u.
1	16,141,360	14,000	451,958
2	11,518,080	13,000	299,470
3	11,621,100	11,000	255,664
4	6,718,880	9,000	120,940
5	1,884,880	8,000	30,158
Total	47,884,300		1,158,190

*Compiled from data in Report of the Royal Commission on Coal, 1946.

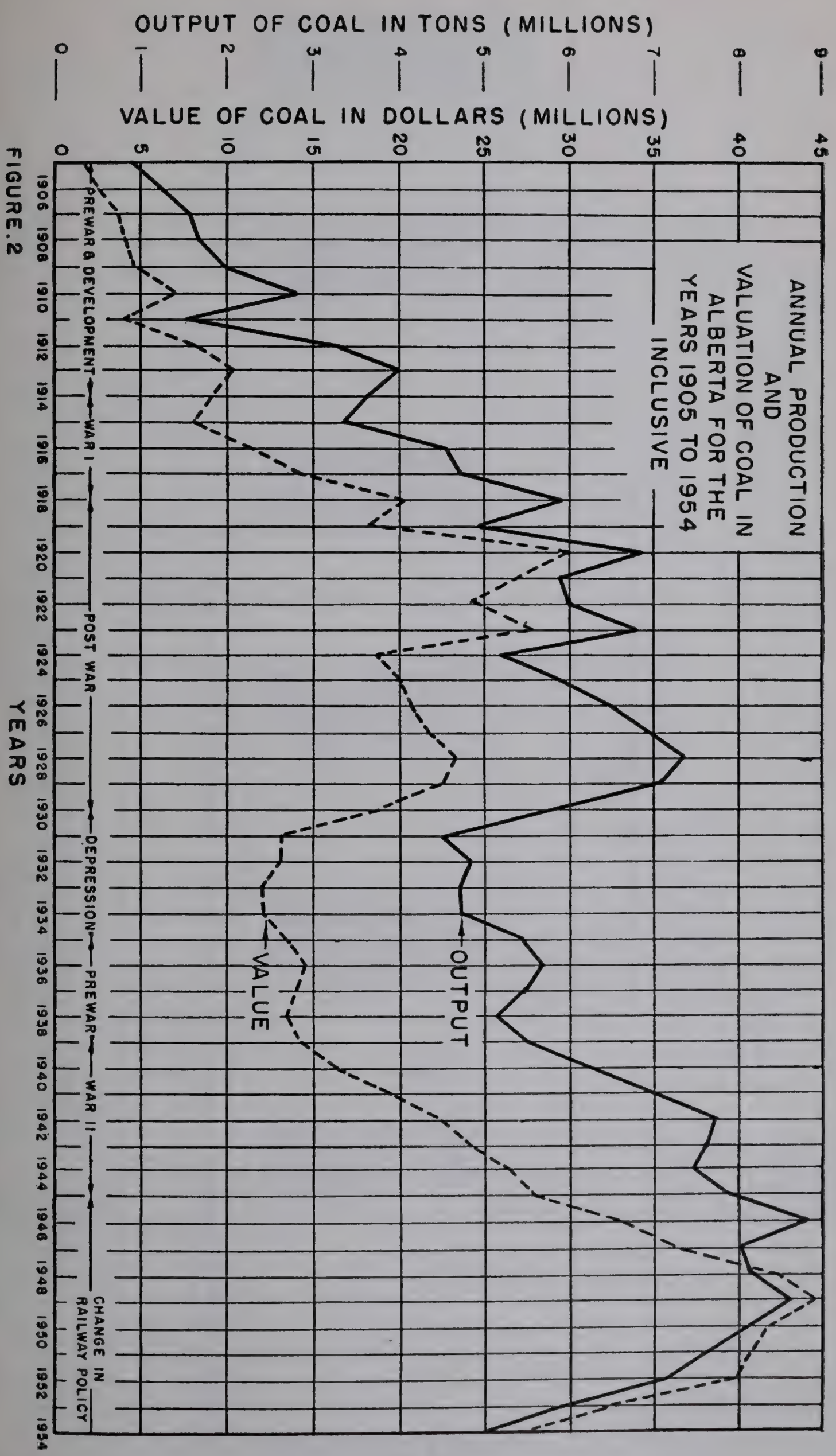


TABLE 4.
PRODUCTION OF ALBERTA COALS BY GROUPS,*
NET TONS

Year	G R O U P					TOTAL PRODUCTION
	1	2	3	4	5	
1944	715,183	2,836,022	1,214,457	2,388,646	273,125	7,428,708
1945	633,893	2,826,843	1,140,027	2,783,358	417,127	7,800,151
1946	646,976	3,366,309	1,376,133	3,034,306	402,587	8,826,311
1947	625,385	2,922,919	1,287,067	2,833,441	401,618	8,070,430
1948	656,921	3,036,903	1,239,633	2,621,497	567,300	8,123,255
1949	644,980	3,594,329	1,254,653	2,647,983	474,910	8,616,855
1950	500,611	3,028,204	1,265,832	2,711,350	610,223	8,116,220
1951	347,781	3,161,552	1,149,979	2,432,663	567,354	7,659,329
1952	581,927	2,733,953	1,062,742	2,152,239	663,896	7,194,757
1953	514,408	2,180,262	822,829	1,729,206	670,718	5,917,474
1954	353,540	1,351,322	697,323	1,785,747	671,204	4,859,136

*Compiled from data in annual reports of the Mines Branch, Department of Mines and Minerals of Alberta.

CONSUMPTION OF ALBERTA COAL IN TONS (MILLIONS)

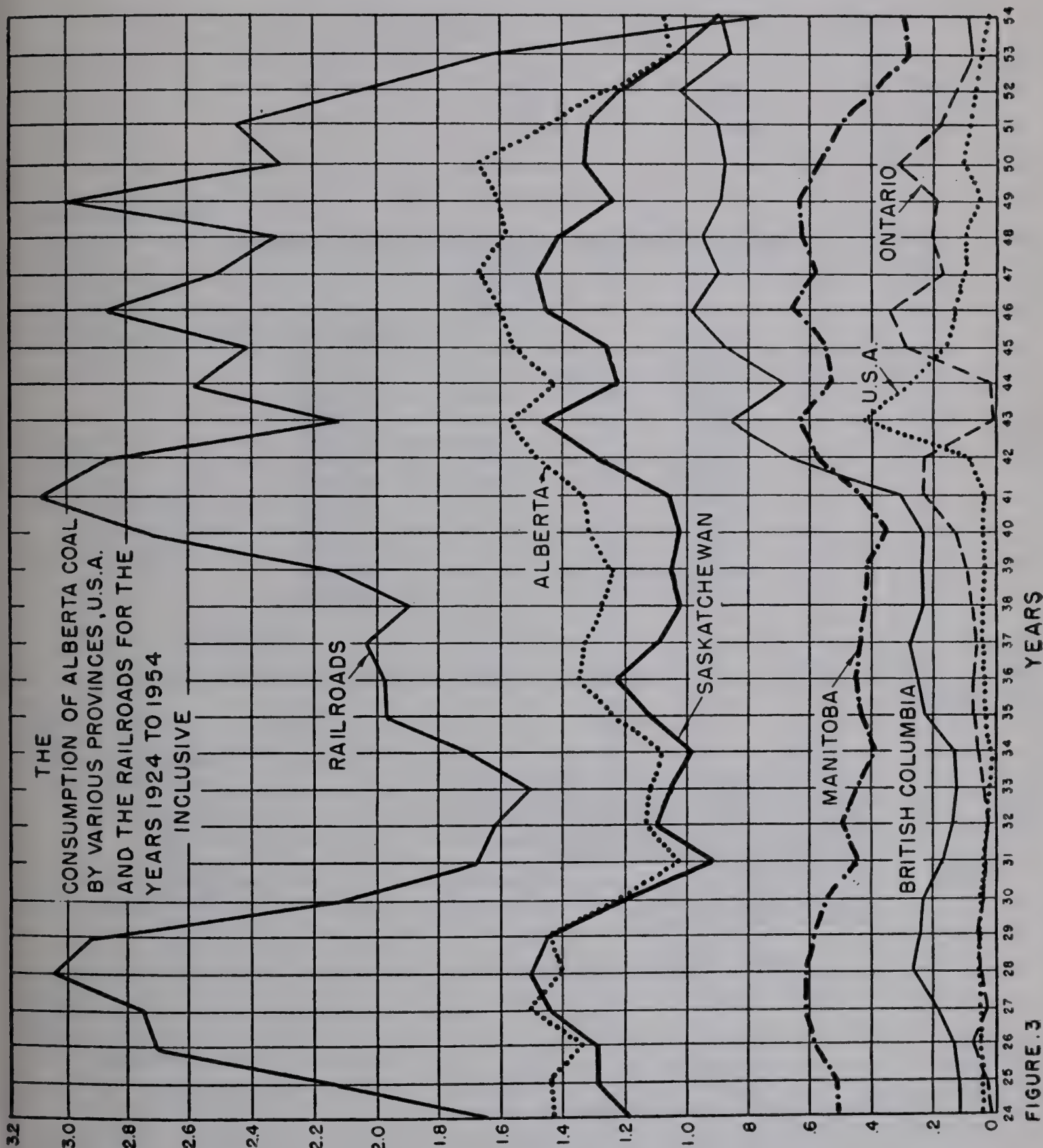


FIGURE 3

TABLE 5.
PRODUCTION OF BRIQUETTES IN ALBERTA
1944 - 1954

Year	Net Tons
1944	253,592
1945	250,274
1946	275,646
1947	282,898
1948	321,574
1949	460,855
1950	409,855
1951	344,026
1952	653,596
1953	664,611
1954	635,501

The disposition of the briquettes for 1954, which is typical of other years, was as follows:

	Tons
Sold for consumption in Alberta	10,452
Sold for consumption in other provinces	92,310
Sold to railroad companies	530,828
Used under colliery boilers	107
Put to stock	45,730
Lifted from stock	42,541
Lifted from Waste	1,385
Total output of briquettes	653,501

TABLE 6.

OPERATING COSTS AND REVENUES

Per Net Ton of Marketable Coal Produced in Alberta, 1952*

	Alberta Prairie Cost		Alberta Foothills Cost		Alberta Mountain Cost	
	%	\$	%	\$	%	\$
Operating Costs						
Labour	52.7	2.64	50.9	3.19	49.2	3.02
Welfare Fund	1.9	.10	2.1	.13	2.5	.15
Vacation Pay	1.7	.09	1.2	.08	1.5	.09
Workmen's Compensation	3.0	.15	2.8	.17	2.3	.14
Maintenance, Repairs and Supplies	10.9	.55	12.5	.78	11.5	.70
Total Mine Costs	70.2	3.53	69.5	4.35	67.0	4.10
Taxes and Insurance	2.6	.13	3.2	.20	2.2	.13
Power	1.9	.09	6.5	.41	4.2	.26
Royalties	2.8	.14	1.5	.09	1.3	.07
Administration and Supervision	6.3	.31	5.3	.33	3.4	.22
Miscellaneous Expenses	.7	.03	.3	.02	.8	.05
Total Cost to Tipple	84.5	4.23	86.3	5.40	78.9	4.83
Tipple and Wash Plant	4.3	.21	3.7	.24	10.4	.64
Total Cost F.O.B. Cars	88.8	4.44	90.0	5.64	89.3	5.47
Depreciation	4.6	.23	5.9	.37	6.2	.38
Depletion	1.7	.08	1.7	.10	1.1	.07
Bond and General Interest	1.0	.05	1.2	.08	2.2	.14
Distribution	3.9	.20	1.2	.07	1.2	.07
Total Costs	100%	5.00	100%	6.26	100%	6.13
Coal Produced (net tons)	3,329,188		617,823		3,040,955	
Tons Produced per Man-Day	5.12		4.18		4.71	
	\$		\$		\$	
Revenues						
Coal Sales	5.23		6.06		6.19	
Misc. Income and Stock Adjustments	.10		.11		.20	
Total Income	5.33		6.17		6.39	
Profit (P) or Loss (L)	(P) .33		(L) .09		(P) .26	

*Dominion Coal Board Annual Report 1953-1954 pp. 42-43.

TABLE 7.

LABOUR STATISTICS FOR COAL MINES OF ALBERTA*

Year	Coal Mines No.	Employees No.	Salaries and Wages \$	Average Salary or Wage per employee \$
1944	202	8,373	17,234,051	2,058
1945	199	8,276	16,981,817	2,052
1946	198	8,563	18,500,547	2,160
1947	191	8,710	20,017,887	2,298
1948	195	8,807	21,630,754	2,456
1949	205	8,702	22,742,079	2,613
1950	207	8,012	20,754,856	2,590
1951	179	7,353	21,198,140	2,883
1952	157	6,958	20,891,703	3,003
1953	146	5,759	16,757,112	2,913
1954	136	4,719	Data not available	

*Facts and Figures, Alberta 1954.

TABLE 8.

SUBVENTION FOR MOVEMENT OF ALBERTA COAL AUTHORIZED BY P.C. 1954-688*

Province	Movement	For use by	Rate of Assistance	Payable to
Alberta and B.C. (Crowsnest) P.C. 1954-688 May 6, 1954 Sec. 3(a)	By rail to points in the Province of Ontario to which the freight rate is less than \$8.60 per net ton.	All consumers other than Railways in locomotives.	20% of freight rate.	The Railways.
Sec. 3(b)	By rail to points in the Province of Ontario to which the freight rate is \$8.60 per net ton or more.	Industrial use other than Railways in locomotives.	\$3.50 per net ton.	The Railways.
Sec. 3(c) (i)	By rail to points in the Province of Ontario to which the freight rate is in excess of \$9.00 per net ton but less than \$10.75 per net ton.	Other than industrial use.	\$3.00 per net ton.	The Railways.
Sec. 3(c) (ii)	By rail to points in the Province of Ontario to which the freight rate is \$10.75 per net ton or in excess thereof.	Other than industrial use.	\$3.50 per net ton.	The Railways.
Sec. 3(d)	By rail to points in the Provinces of Ontario, Manitoba and Saskatchewan.	For use by Railways in locomotives.	Difference between laid down cost of Alberta coal and imported coal or the sum of \$4.00 per net ton, whichever is the less.	The Railways.

*Dominion Coal Board Annual Report 1953-54 p. 79

TABLE 9.
SUBVENTION RATES PAID TO RAILWAYS FOR THE ASSISTANCE OF ALBERTA COAL TO MARKETS—1944 - 1954*

YEAR	B.C.		SASK.		MAN.		ONT.		PAID re ALTA.	PAID re CANADA	
	DOMESTIC Per Ton \$		RAILWAY Per Ton \$	AVERAGE Per Ton \$	INDUSTRIAL Per Ton \$	RAILWAY Per Ton \$	DOMESTIC Per Ton \$	INDUSTRIAL Per Ton \$	AVERAGE Per Ton \$	AVERAGE Per Ton \$	
1944	0.65						2.50	1.81	1.58	1.69	2.05
1945	0.65						2.50	1.82	1.63	2.30	1.77
1946	0.65			.30	.30		2.50	1.39	1.58	2.11	1.38
1947	0.65		.30	.30	.30		2.50	1.68	1.58	2.28	1.21
1948				.52	.52		2.50	1.56	1.46	2.28	.94
1949	0.75		1.60	1.60	1.29		2.50	1.29	1.79	2.17	1.41
1950			1.31	1.31	1.30		2.50	1.30	1.25	2.03	1.23
1951	0.75		.99	.99	1.30		2.81	1.30	1.64	2.09	1.42
1952	0.75	.95	1.04	1.04	1.32		3.15	1.32	1.79	2.41	2.41
1953	0.75	.72	1.06	1.06	1.37		3.12	1.37	2.08	2.41	2.69
1954	0.75	2.70	3.40	3.40	1.39		3.23	1.39	3.21	3.12	3.13

*Data taken from Facts and Figures, Alberta, 1954.

Alberta's Economic Prospects

**ALBERTA'S
CRUDE OIL, NATURAL GAS
AND
NATURAL GAS LIQUIDS
RESOURCES**

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December 1955

4. CRUDE OIL, NATURAL GAS, NATURAL GAS LIQUIDS AND SULPHUR

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ALBERTA CRUDE OIL, NATURAL GAS, NATURAL GAS LIQUIDS AND SULPHUR

INTRODUCTION

Since the turn of the century crude oil and natural gas have risen rapidly in their roles as energy source materials. For example, in 1952 some 60 per cent of the total U.S. energy supply was derived from oil and natural gas as compared to some 50 per cent in 1945 and some 18 per cent in 1920.¹ A similar shift is evident for Canada. In 1952 some 46 per cent of the total Canadian energy supply was derived from petroleum and natural gas as compared to only 27 per cent in 1945.² The supply of these fuel materials is of prime importance to the long term economic developments of Canada as a whole and in particular to Alberta. The degree to which reserves of crude oil and natural gas will be discovered and developed in the future will be dependent upon the actual extent of these resources, the cost of finding and recovering them, the demand for fuel or energy, and the cost of competitive sources of fuel or energy. Economic conditions, technological advances, alternate sources of energy, population, standards of living and numerous other factors will all play a part in determining the future levels of demand. One thing that is certain, however, is that crude oil and natural gas will continue to be vital sources of energy supply for the next two or three decades.

All estimates of reserves contained in this study are on an economically recoverable or marketable basis, all appropriate deductions having been made. Increases in recovery efficiencies with improved technology have not been taken into account and to that extent the estimates are conservative. Apart from this, every effort has been made to produce figures that are neither optimistic nor conservative but as realistic as possible.

In assessing the future market demand for Alberta crude oil and natural gas it has been assumed that no significant changes will occur in the factors which influence the demand for crude oil, natural gas and natural gas liquids, and that surplus future production will move freely to economic outside markets.

CRUDE OIL *

Reserves

World reserves of crude oil at the end of 1954 were estimated to be 153.3 billion barrels and the total demand for crude oil averaged 13.7 million barrels per day.³ The North American continent possessed 22.4 per cent (34.4 billion barrels) of the reserves and produced 49.4 percent (6.8 million barrels per day) of the total daily average production. The U.S. alone accounted for 19.8 percent of the total reserves and 45.9 percent of the total production. Canada held 1.56 percent of the total reserves and produced 1.92 percent of the total production.

A review of the recent growth in reserves of Alberta crude oil and its relation to annual production is presented in Table 4-1. The reserve

1 H. J. Struth, World Petroleum Statistical Yearbook, Vol. 1, 1953-54 Edition.

2 C. L. O'Brian, C.I.M. M. Trans. Vol. 16, 1953.

3 World Oil, February 15, 1955.

* Includes Condensate but not Natural Gas liquids.

TABLE 4-1
ESTIMATED PROVEN RECOVERABLE RESERVES AND PRODUCTION OF ALBERTA CRUDE OIL *
(Millions of Barrels)

Year	Year-End Remaining Recoverable Reserves	Annual Production	Cumulative Production	Virgin Recoverable Reserves	Life-Index** Years
1946	72	7	85	157	10
1947	180	6	91	271	30
1948	512	10	101	613	51
1949	925	20	121	1,046	46
1950	1,100	27	148	1,248	41
1951	1,326	46	194	1,520	29
1952	1,557	59	253	1,810	26
1953	1,915	77	330	2,245	25
1954	2,187	88	418	2,605	25
1956	2,935	120	665	3,600	24
1958	3,445	164	955	4,400	21
1960	4,000	200	1,350	5,350	20
1970	4,400	320	4,100	8,500	14
1980	4,200	400	7,800	12,000	11

*Includes condensate but not natural gas liquids.
**Ratio of Year-End Remaining Recoverable Reserves to Annual Production.

figures represent the total of carefully compiled estimates for all individual pools in the Province, each estimate being based on all available data on reservoir and production characteristics and referring to proven economically recoverable oil. The total reserve figures for the years 1951 to 1954 are in close agreement with those arrived at by the Reserves Committee of the Canadian Petroleum Association. The Association made no such estimates prior to 1951. The significance of the reserve estimates is indicated by the ratio of the year-end remaining recoverable reserves to the annual production. This ratio, called the life-index, has increased from 10 years, through a figure of some 50 years, to its present value of about 25 years. A similar ratio based on total present Canadian market requirements for crude oil, including imported refined products, is about 11.8 years—the same as the comparable figure for the United States.

Drilling and Exploration

A total of some 9,400 wells had been drilled in Alberta by the end of 1954. Of this number, approximately 2,900 were classed as wildcat wells. When related to the virgin recoverable reserves which have been developed, this number of wildcat wells indicates an average discovery rate of approximately 900,000 barrels of virgin recoverable reserves per wildcat well. Present indications are that the discovery rate will remain stable for some 10 or so years at near this figure and then will tend to decline as the remaining undiscovered reserves decrease.

Details of past drilling and exploration activity are presented in Appendix 4-3. These statistics indicate that, since 1947, approximately 70 percent of the total wells drilled were successful in finding oil or gas in commercial quantities. Statistics for the recent years indicate that about 30 percent of the wildcat wells drilled were successful.

Production and Markets

Prior to 1947 Alberta had one major oil field and an average daily crude oil production rate of less than 20,000 barrels. With the discovery of the Leduc Field in 1947 and the Redwater Field in 1948, available production saturated the local demand. At that time the actual production was some 54,000 barrels per day and the potential production some 79,000 barrels per day. The recoverable reserves were approximately 925 million barrels. The Ontario market was needed to close the gap between the rising potential production and actual requirements of the prairie markets.

In 1950 the Interprovincial Pipeline was completed extending from Edmonton to Superior, Wisconsin and having an initial throughput capacity of 95,000 barrels per day. Since then the line has been extended from Superior to Sarnia, Ontario and, by looping and additional pump stations, the present capacity out of Edmonton has been increased to approximately 200,000 barrels per day. Despite the expansion in markets provided by the Interprovincial Pipeline, crude oil reserves continued to increase significantly making it possible and desirable to supply other market areas. In 1953 the Trans Mountain Pipe Line was completed extending from Edmonton to the markets on the West Coast. Today Alberta crude oil is able to compete with alternate crudes in both the eastern and western market areas.

Details of the growth in the production of and the markets for Alberta crude oil are given in Table 4-2 and illustrated in Figure 4-1. Table 4-2 indicates the decline in the ratio of actual to potential production between 1948 and 1950 when potential production increased more rapidly

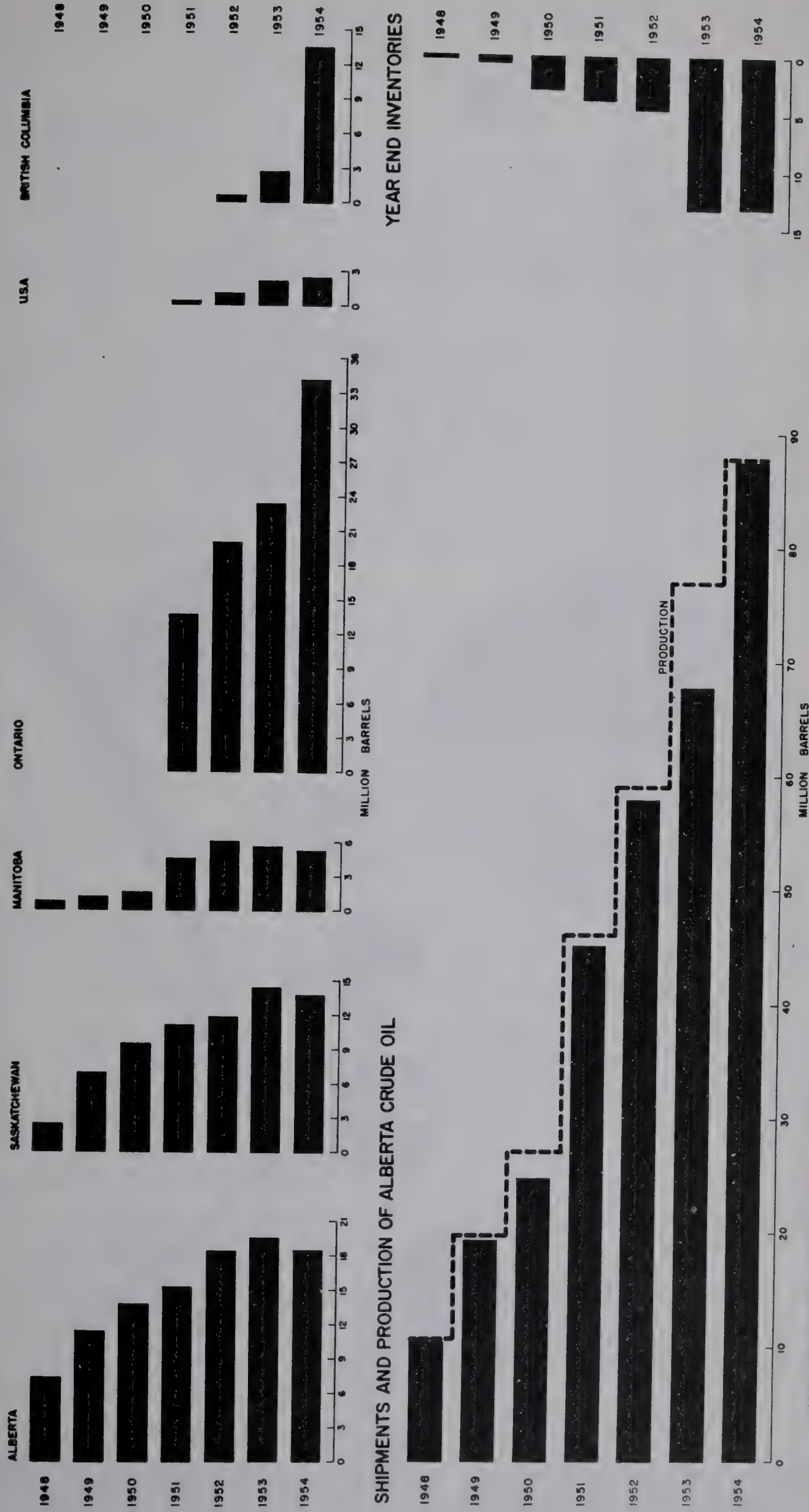
TABLE 4-2
ESTIMATED PRODUCTION, POTENTIAL PRODUCTION, AND MARKETS FOR ALBERTA CRUDE OIL*
(Thousand Barrels Per Day)

Year	Production	Potential Production	Ratio Actual to Potential Production (Percent)	Alberta	M A R K E T S Other Canada**	Export*** and/or Quebec	Total
1946	18	18	100	17	1	—	18
1947	18	18	100	17	1		18
1948	29	29	100	20	9		29
1949	54	79	68	31	22		53
1950	74	146	51	38	30		68
1951	126	203	62	42	80	1	123
1952	161	264	61	50	105	3	158
1953	211	317	67	53	126	6	185
1954	240	343	70	50	182	7	239
1956	330	580	57	60	200	70	330
1958	450	740	61	70	205	175	450
1960	550	900	61	75	235	240	550
1970	880	1,300	68	100	300	480	880
1980	1,100	1,500	75	140	330	530	1,100

*Includes condensate but not natural gas liquids.
**Excluding Quebec.
***From Canada.

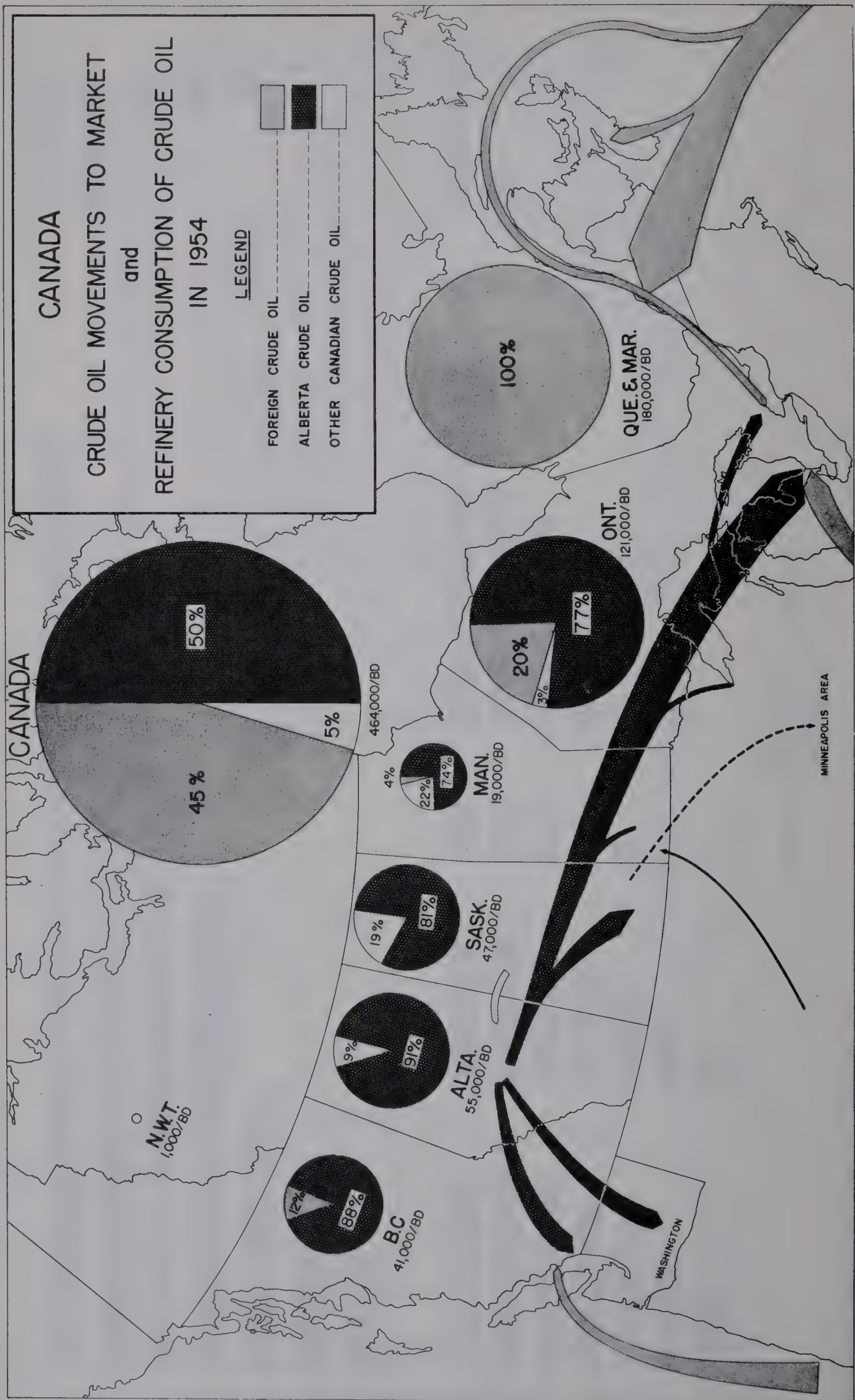
FIGURE 4-1

ALBERTA COMPARATIVE CRUDE OIL DISPOSITION 1948-1954



SOURCE: THE PETROLEUM & NATURAL GAS CONSERVATION BOARD
CALGARY, ALBERTA.

FIGURE 4-2



than markets. From 1950 to 1954 this ratio has increased with the expansion of markets provided by the construction of the long distance pipe lines. The current market picture is illustrated in Figure 4-2.

Future Reserves

Any consideration of the present and long term supply and demand status for crude oil in Canada and the United States indicates that there will be no long term lack of incentive to explore for and develop additional reserves of crude oil in Alberta. The rate of this development at any given time, however, will be influenced by the various factors referred to in the introductory section.

Two approaches have been employed in estimating the future recoverable reserves of crude oil. One approach, based upon geological thinking and the volume of oil-containing sediments estimated to exist in the Province leads to a figure of some 15 billion barrels of economically recoverable crude oil. Details of this estimate are given in Appendix 4-2. A second approach based upon the record of success of wildcat wells and the area of prospective oil and gas lands in the Province leads to a figure, as of 1980, of approximately 12 billion barrels of virgin economically recoverable crude oil.

The second approach is based upon the fact that there are some 200,000 square miles of prospective oil and gas lands in the Province and on the following three assumptions:

- (a) Any large area of prospective oil and gas lands can be reasonably explored with a wildcat drilling density of one well per 10 square miles. From this it would follow that approximately 20,000 wildcat wells would effectively explore the 200,000 square miles of lands.
- (b) Virgin recoverable reserves of approximately 800,000 barrels may be expected, on the average, from the drilling of one wildcat well.
- (c) The incentive for exploration and development in Alberta will result in the continued drilling of some 500 to 700 wildcat wells each year, or some 15,000 wildcat wells by 1980. In other words, the prospective oil and gas lands would be about 75 percent explored by 1980.

A definite advantage of this second approach is that it yields figures on the rate of growth of virgin recoverable reserves. These figures are presented in Table 4-1 for the years 1958, 1960, 1970 and 1980. The estimates are believed to be realistic.

Future Production and Markets

The estimated future production of Alberta crude oil and the markets for it have been established on the basis of:

- (a) estimated population growth and per capita consumption in the areas presently supplied;
- (b) the expected development of competing crude oil production in certain market areas; and
- (c) an allowance for new markets.

It was assumed that both Saskatchewan and Manitoba would become self-sufficient in crude oil by 1960 and that thereafter any surplus production

would enter the Ontario market tending to satisfy its normal growth. Accordingly, new markets for Alberta crude oil are assumed to arise either through increased exports from Canada and/or through expansion of the present eastern market to include Quebec.

The estimated future production of crude oil in Alberta is given in Table 4-1. It will be noted that these figures indicate a life-index declining from its present value of 25 years to some 11 years by 1980. The breakdown of these future production figures according to market distribution is presented in Table 4-2 which also shows the relatively stable ratio of actual to potential production which is anticipated. By 1980 it is estimated that from a potential production of 1.5 million barrels per day Alberta will be producing over one million barrels per day, of which some 80 percent would move beyond the Province. The value of this production would be about \$2,500,000.00 per day.

Crude Oil As An Energy Source Material

The year-end remaining recoverable reserves and the production figures from Tables 4-1 and 4-2 have been expressed in terms of energy content measured in trillions of B.T.U.'s. These figures are presented as a recapitulation in Table 4-3.

TABLE 4—3
RECAPITULATION
ESTIMATED RESERVES AND PRODUCTION OF ALBERTA CRUDE OIL*
(Trillions of B.t.u.'s)

Year	Year-End Remaining Recoverable Reserves	Production (Market Requirements)		
		Alberta	Export	Total
1946	418	36	2	38
1948	2,973	42	19	61
1950	6,388	80	63	143
1952	9,043	106	228	334
1954	12,702	106	401	507
1956	17,000	130	570	700
1958	20,000	150	800	950
1960	23,000	160	1,000	1,160
1970	26,000	200	1,650	1,850
1980	24,000	300	1,800	2,100

*Includes condensate but not natural gas liquids.

NATURAL GAS, NATURAL GAS LIQUIDS, AND SULPHUR

Reserves

At the end of 1954 the total marketable reserves of natural gas in the United States were estimated to be approximately 212 trillion cubic feet and the total marketed production during 1954 was some 8.7 trillion cubic feet. In Canada the estimated marketable reserves were some 18.7 trillion cubic feet and the total marketed production was some 113 billion cubic feet. (See Appendix 4-1.)

A review of the recent growth in marketable reserves of Alberta natural gas and its relation to annual marketed production is presented in Table 4-4. The figures for the period 1952 to 1954 are taken from the

1954 report of the Board but corrected to the year-ends. As in the case of the crude oil estimates, these figures are totals of carefully compiled estimates for all individual pools in the Province, each estimate being based on all available data on reservoir and production characteristics and referring to proven economically producible and marketable gas. It will be noted that the life-index figure is extremely high reflecting the large ratio existing between remaining marketable reserves and marketed production. This is a direct result of the fact that a substantial export market is not now being served. The corresponding life-index figure for the United States at present is some 24 years.

TABLE 4—4
ESTIMATED MARKETABLE RESERVES AND MARKETED PRODUCTION OF
ALBERTA NATURAL GAS
(Trillions of Cubic Feet)

Year	Year-End Remaining Marketable Reserves	Annual Marketed Production	Cumulative Marketed Production	Virgin Marketable Reserves	Life-Index* Years
1952	9.92	.07	2.13	12.05	142
1953	11.48	.07	2.20	13.68	164
1954	15.32	.10	2.30	17.62	153
1956	17.41	.15	2.59	20.00	116
1958	20.00	.33	3.23	25.20	61
1960	22.70	.55	4.10	26.80	48
1970	34.00	1.10	11.00	45.00	31
1980	35.00	1.40	25.00	60.00	25

*Ratio of Year-End Remaining Marketable Reserves to Annual Marketed Production.

The virgin marketable reserve figures given in Table 4 - 4 when analyzed in conjunction with the number of wildcat wells which have been drilled in the Province indicate that on the average the virgin marketable reserves have increased by approximately 6 billion cubic feet for each wildcat drilled. It is expected that the discovery rate will remain near this figure for some years and then will decline as the remaining undiscovered reserves decrease.

Production and Markets

Details of the growth in the production of and the markets for Alberta natural gas are presented in Table 4-5. These figures indicate that to the end of 1950 all marketed gas was sold within the Province. Following this small quantities of gas have gone to export markets starting with export of gas to Dawson Creek, British Columbia in 1951 and to Montana in 1952.

The lack of export in larger quantities is not an indication of the absence of an export market but rather a result of the policy of the Alberta Government concerning the export of natural gas. This policy is reflected in The Gas Resources Preservation Act and in the several reports⁴ of the Board dealing with applications for permits to export gas from the Province. The Government agreed with the Board's judgment that a supply of gas adequate to meet the requirements of the Province for a period of approxi-

(4) Report of The Petroleum and Natural Gas Conservation Board to the Lieutenant Governor in Council dated January 20, 1951, March 29, 1952, November 24, 1953 and May 10, 1954.

TABLE 4—5
MARKETS FOR ALBERTA NATURAL GAS
(Billions of Cubic Feet)

Year	Alberta	Export	Total
1946	35.0		35.0
1948	41.0		41.0
1950	51.5		51.5
1952	55.9	8.5	64.4
1954	80.9	7.6	88.5
1956	100	50	150
1958	129	201	330
1960	150	400	550
1970	210	890	1,100
1980	250	1,150	1,400

mately 30 years should be reasonably assured before extensive export was started. In the 1953 report of the Board, surplus natural gas was allocated to the project of Westcoast Transmission Company Limited for export to southwestern British Columbia and the market area of the northwestern United States. While this project has not yet come into fruition, it is expected that export to these market areas will start in the fall of 1956. In the 1954 report of the Board a surplus adequate for the supply of natural gas to the large market of Eastern Canada and to certain markets of the north central United States was declared and authority was granted to Trans-Canada Pipe Lines Limited to export some 183 billion cubic feet per year. The Trans-Canada project has been delayed because of difficulties concerning the contracting for the natural gas supplies and financing. It now appears that there is every chance that this project will be undertaken within the next two years.

Future Reserves

The same two approaches previously discussed in the case of crude oil were employed to estimate the future marketable reserves of natural gas. The geological approach led to a figure of some 100 trillion cubic feet of virgin economically recoverable marketable gas. The details are given in Appendix 4-2. The second approach, based upon a success record of wildcat wells and the area of prospective oil and gas lands in the Province, resulted in a figure, as of 1980, of approximately 60 trillion cubic feet of virgin economically recoverable marketable natural gas. Table 4-4 presents the figures estimated by this second method for the years 1958, 1960, 1970 and 1980. These figures are considered to be realistic.

Future Production and Markets

Estimated figures for the future production and markets for Alberta natural gas appear in Tables 4-4 and 4-5. These estimates have been based on methods similar to those which were used in the case of crude oil. The rapid increase in markets over the next five years is based upon the expected early sale of Alberta natural gas in both the eastern and western markets through the completion of the Trans-Canada and the Westcoast Transmission projects. Growth of the markets thereafter is based on population growth, growth in per capita consumption as well as increased saturation in the market areas. It is significant to note that the production figures consistent with these market requirements give rise to declining life-index figures and that the estimated life-index figure for 1980 is about the same

as that now prevailing in the United States. This serves as a definite cross-check on the realism of the figures. By 1980 it is estimated that from remaining marketable reserves of some 35 trillion cubic feet, Alberta will be marketing nearly 1.5 trillion cubic feet per year of which some 80 per cent would move beyond the Province. With a value of only 10 cents per MCF the total value of this production would be about \$140,000,000.00 per year.

Natural Gas As An Energy Source Material

The year-end remaining marketable reserves and the production figures from Tables 4-4 and 4-5 have been expressed in terms of energy content measured in trillions of B.T.U.'s. These figures are presented as a recapitulation in Table 4-6.

TABLE 4—6
RECAPITULATION
ESTIMATED MARKETABLE RESERVES AND MARKETING PRODUCTION OF
ALBERTA NATURAL GAS
(Trillions of B.t.u.'s)

Year	Year-End Marketable Reserves	Production (Market Requirements)		
		Alberta	Export	Total
1952	9,920	56	19	65
1953	11,480	64	10	74
1954	15,320	81	8	89
1956	17,410	100	50	150
1958	20,000	129	201	330
1960	22,700	150	400	550
1970	34,000	210	890	1,100
1980	35,000	250	1,150	1,400

NATURAL GAS LIQUIDS AND SULPHUR

Reserves

A review of the recent growth in recoverable reserves of Alberta natural gas liquids and sulphur and its relation to annual production is presented in Table 4-7. The figures for 1954 and 1956 are based on the reserves estimated by The Petroleum and Natural Gas Conservation Board as of September, 1955, but corrected to the year-ends, and being approximately 341 million barrels for natural gas liquids and approximately 19 million tons for sulphur. As in the case of the crude oil and natural gas estimates, these figures are totals of carefully compiled estimates for all individual pools in the Province.

Future Reserves and Production

The estimates of future reserves of natural gas liquids and sulphur shown in Table 4-7 have been derived through the application of a factor, based upon present relationships, to the estimates of year-end remaining disposable reserves of natural gas. The estimates of future production of natural gas liquids and sulphur are similarly derived. The relationships employed in these estimates are averages and are useful only to give the general magnitude of the volumes of remaining reserves and annual production that reasonably can be expected.

TABLE 4—7
ESTIMATED PRODUCTION AND RESERVES OF NATURAL GAS LIQUIDS AND SULPHUR IN ALBERTA

Year	PLANT PRODUCTION**					Year-End Recoverable*** Reserves	
	Natural Gas to Plant*	Propane	Butane	Natural Gasoline	Total Natural Gas Liquids	Sulphur	Total Natural Gas Liquids Sulphur
1950	32	141	34	446	621		
1952	41	338	140	580	1,058	9	
1954	56	529	245	682	1,456	22	334
1956	90	1,000	400	1,200	2,600	35	380
1958	180	2,200	800	2,400	5,400	75	420
1960	290	3,500	1,200	4,000	8,700	120	480
1970	730	8,800	3,200	10,000	22,000	300	700
1980	950	11,600	4,400	12,000	28,000	400	750

*In billions of cubic feet per year.

**In thousands of barrels per year for liquids; thousands of tons per year for sulphur.

***In millions of barrels for liquids; millions of tons for sulphur.

The estimated deliveries of natural gas to plants are based upon expected volumes of conserved oil-field natural gas and other wet natural gas that will be required along with dry natural gas to supply the total estimated markets. The allocation of total liquid production to propane, butane and natural gasoline is arbitrary and done on a percentage basis. For example, the product distribution in 1980 is approximately 40 percent propane, 15 percent butane and 45 percent natural gasoline. In addition to those specified it is possible to process the natural gas further for other products such as ethane. The degree of ethane extraction will depend upon the level of its demand in Alberta, particularly by the petrochemical industry.

It is seen from Table 4-7 that the year-end remaining recoverable reserves of natural gas liquids and sulphur are expected to increase from 334 million barrels in 1954 to around 750 million barrels in 1980 for natural gas liquids and from 18 million tons to 45 million tons for sulphur. The production of these products is expected to increase approximately 18 times over the same period.

To date approximately the entire production of natural gas liquids has gone to local markets. However, the increased production that may be expected in the near future will present problems in the matter of developing new markets both within and outside the Province. Future markets will be forthcoming by way of requirements for the petro-chemical industry, domestic uses, internal combustion requirements and crude petroleum blends for refineries. A conservative estimate of these requirements in Alberta in 1980 would be in the order of 6 to 8 million barrels. It is expected that the remaining production amounting to approximately 75 percent to 80 percent of the total would move beyond the Province.

SUMMARY

It is believed that there will be continued incentive to undertake the exploration and development necessary to develop and exploit Alberta reserves by 1980 to about the extent indicated below.

	Crude Oil (Barrels)	Natural Gas (Cubic Feet)
Developed Reserves	12 billion	60 trillion
Produced Reserves	7.8 billion	25 trillion
Remaining Developed Reserves	4.2 billion	35 trillion

It is estimated that the approximate increase in production in 1980 over 1955 rates will be 3.5 times for crude oil, 14 times for natural gas and 15 times for natural gas liquids.

It is believed that the development of the oil and gas industry to the degree predicted by 1980 will require considerable capital expenditure for exploration, the drilling of some 40 - 50 thousand wells, and the construction of additional pipe line facilities and new refinery capacity.

The year-end remaining reserves and production figures from Tables 4-1, 4-2, 4-4, 4-5 and 4-7 have been expressed in terms of energy content measured in trillions of B.T.U.'s. These figures are presented as a recapitulation in Table 4-8 and graphically in Figures 4-3 and 4-4. It is seen from Table 4-8 that by 1980 the Alberta oil and gas industry will have a developed energy reserve of around 63,000 trillion B.T.U.'s and an annual rate of energy production of around 3,600 trillion B.T.U.'s of which some 80 percent will be moved beyond the Province.

TABLE 4—8

RECAPITULATION

ESTIMATED TOTAL RESERVES AND TOTAL PRODUCTION OF ALBERTA CRUDE OIL, NATURAL GAS AND NATURAL GAS LIQUIDS

(Trillions of B.t.u.'s)

Reserves	1954	1960	1970	1980
Crude Oil	12,700	23,300	25,600	24,400
Natural Gas	15,320	22,700	34,000	35,000
Natural Gas Liquids	1,400	2,000	3,000	3,100
Total Reserves	<u>29,420</u>	<u>48,000</u>	<u>62,600</u>	<u>62,500</u>
Production (Market Requirements)				
Alberta				
Crude Oil	106	160	200	300
Natural Gas & Natural Gas Liquids	87	168	236	280
Total Alberta	<u>193</u>	<u>328</u>	<u>436</u>	<u>580</u>
Export				
Crude Oil	401	1,000	1,650	1,800
Natural Gas & Natural Gas Liquids	8	418	930	1,230
Total Export	<u>409</u>	<u>1,418</u>	<u>2,580</u>	<u>3,030</u>
Total Production	<u>602</u>	<u>1,746</u>	<u>3,016</u>	<u>3,610</u>
Percent Export	67.9	81.2	85.5	83.9

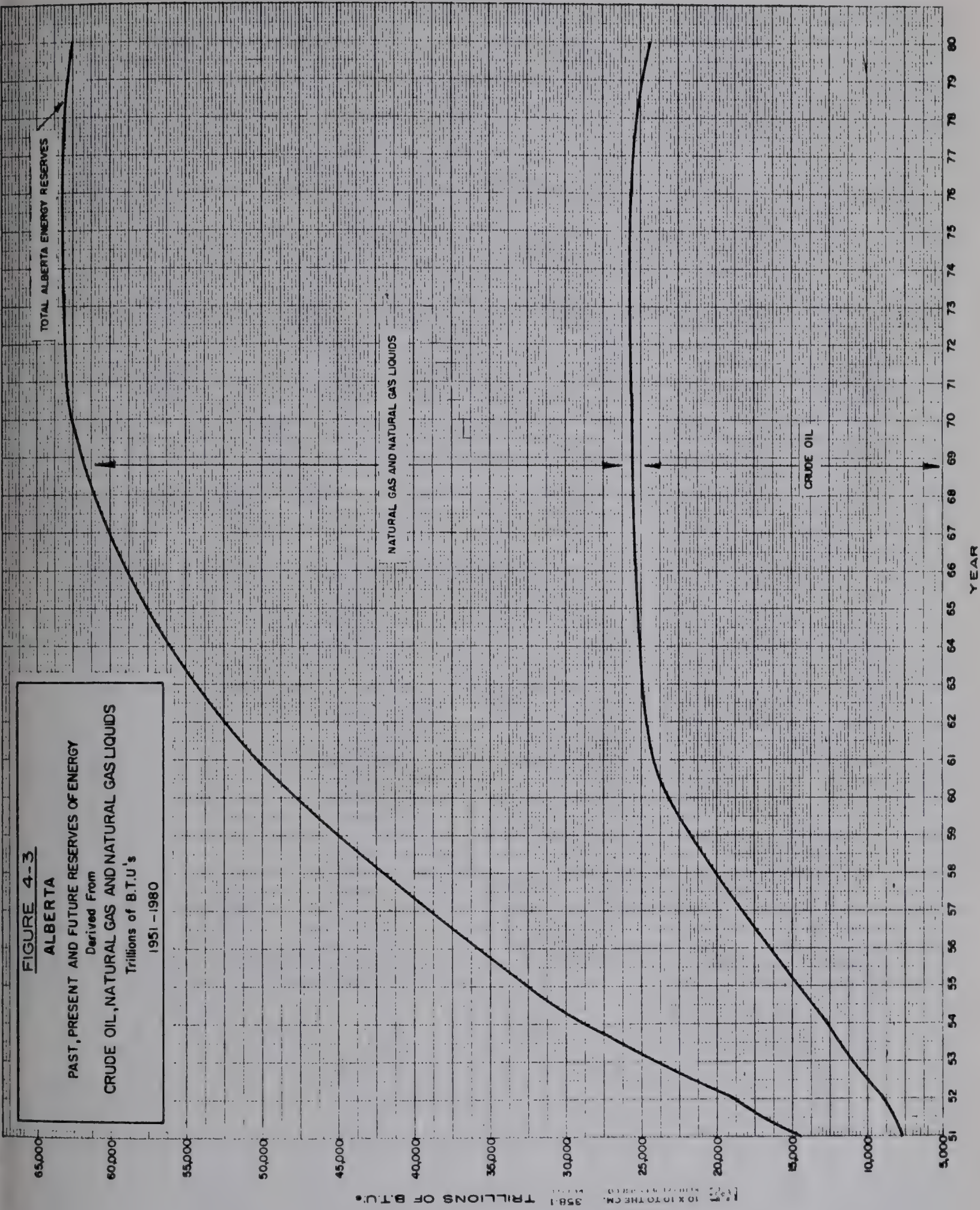
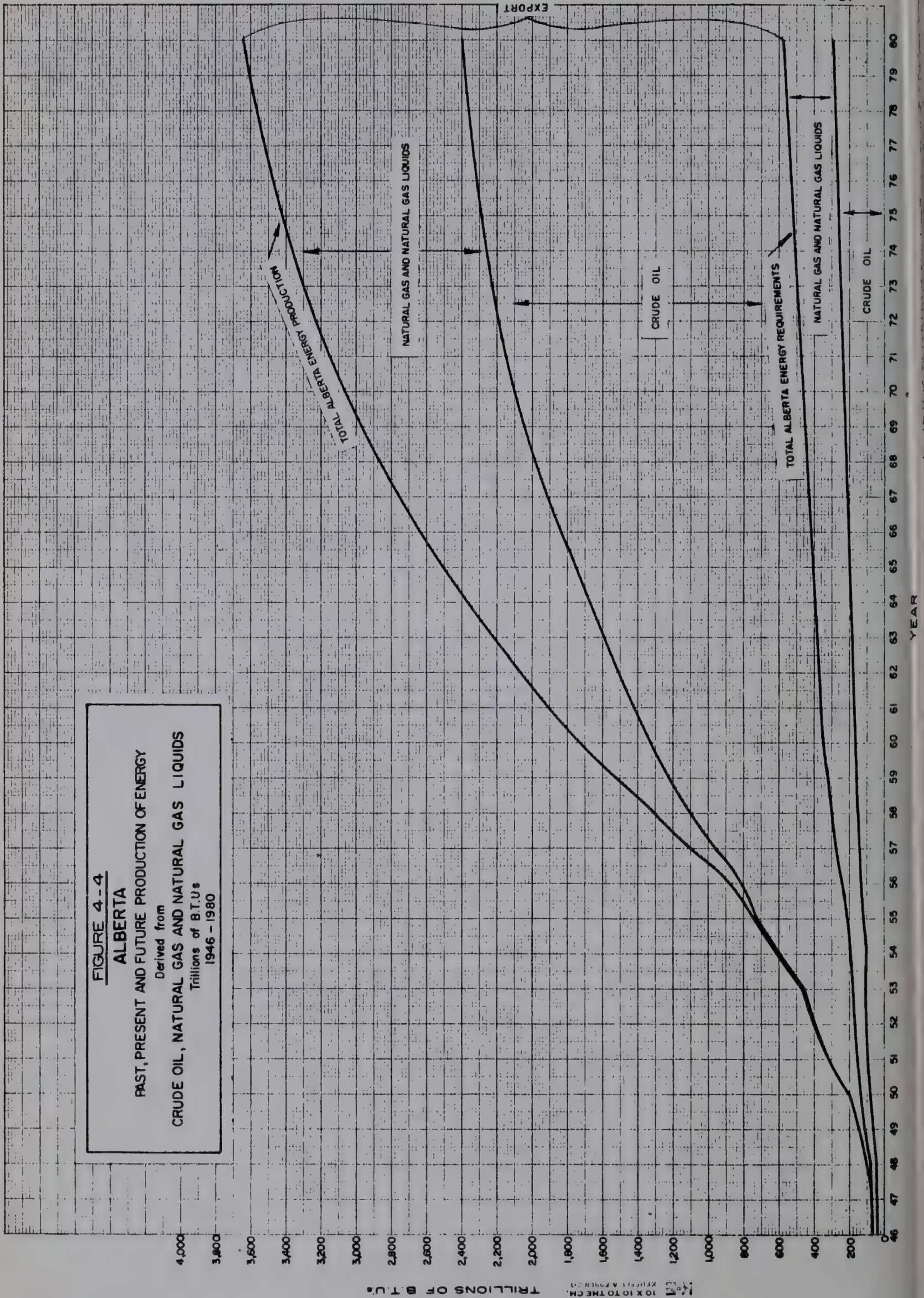


FIGURE 4-4
ALBERTA
 Derived from
PAST, PRESENT AND FUTURE PRODUCTION OF ENERGY
CRUDE OIL, NATURAL GAS AND NATURAL GAS LIQUIDS
 Trillions of B.T.U.s
 1946 - 1980



APPENDIX 4—1

A. SUPPLY AND DEMAND FOR ALL OILS

(a)—United States

	Reserves Total Liquid Hydro- carbons (Millions of Barrels)	Production (Millions of Barrels)	Ratio Reserves to Production	Demand Total Liquid Hydro- carbons (Millions of Barrels)	Ratio Reserves to Demand	Domestic Per Capita Consumption (Barrels per Year)
1946	21,925	1,734	12.6	1,946	11.3	12.6
1947	24,742	2,011	12.3	2,154	11.5	13.7
1948	26,821	2,186	12.3	2,248	11.9	14.3
1949	28,379	2,017	14.1	2,238	12.7	14.1
1950	29,536	2,171	13.6	2,486	11.9	15.5
1951	32,193	2,481	13.0	2,724	11.5	16.5
1952	32,957	2,542	13.0	2,823	11.7	16.8
1953	34,383	2,615	13.1	2,922	11.7	17.2
1954	34,805	2,558	13.6	2,959	11.8	17.3

	Reserves Crude Oil Only (Millions of Barrels)	Production (Millions of Barrels)	Ratio Reserves to Production
1946	20,874	1,726	12.0
1947	21,488	1,850	11.6
1948	23,280	2,002	11.6
1949	24,659	1,819	13.6
1950	25,268	1,944	13.0
1951	27,468	2,214	12.4
1952	27,961	2,257	12.4
1953	28,945	2,312	12.5
1954	29,561	2,257	13.1

Source: U.S. Bureau of Mines—Twentieth Century Petroleum Statistics 1955—
DeGolyer and MacNaughton.

(b) Canada

	Reserves Total Liquid Hydro- carbons (Millions of Barrels)	Production (Millions of Barrels)	Ratio Reserves to Production	Demand Total Liquid Hydro- carbons (Millions of Barrels)	Ratio Reserves to Demand	Domestic Per Capita Consumption (Barrels Per Year)
1952	1,745	62	28.1	169	10.3	11.8
1953	2,044	82	24.9	189	10.8	12.8
1954	2,416	97	24.9	204	11.8	13.4

Source: Canadian Petroleum Association.
No accurate data available for earlier years.

B. Reserves and Production of Natural Gas

(a) United States

	Reserves (Trillions of Cu. Ft.)	Marketed Production (Trillions of Cu. Ft.)	Ratio Reserves To Production
1946 -----	160.6	4.0	40.2
1947 -----	165.9	4.6	36.1
1948 -----	173.9	5.2	33.4
1949 -----	180.4	5.4	33.4
1950 -----	185.6	6.3	29.5
1951 -----	193.9	7.5	25.9
1952 -----	199.7	8.0	25.0
1953 -----	211.5	8.4	25.2
1954 -----	211.7	8.7	24.3

Source: U.S. Bureau of Mines—Twentieth Century Petroleum Statistics 1955—
DeGolyer and MacNaughton.

(b) Canada

No accurate data on reserves available for years prior to 1954.

Reserves at end of 1954—18.7¹ trillion cubic feet

Market Requirements (based on sales of natural and manufactured gas)—
113² billion cubic feet.

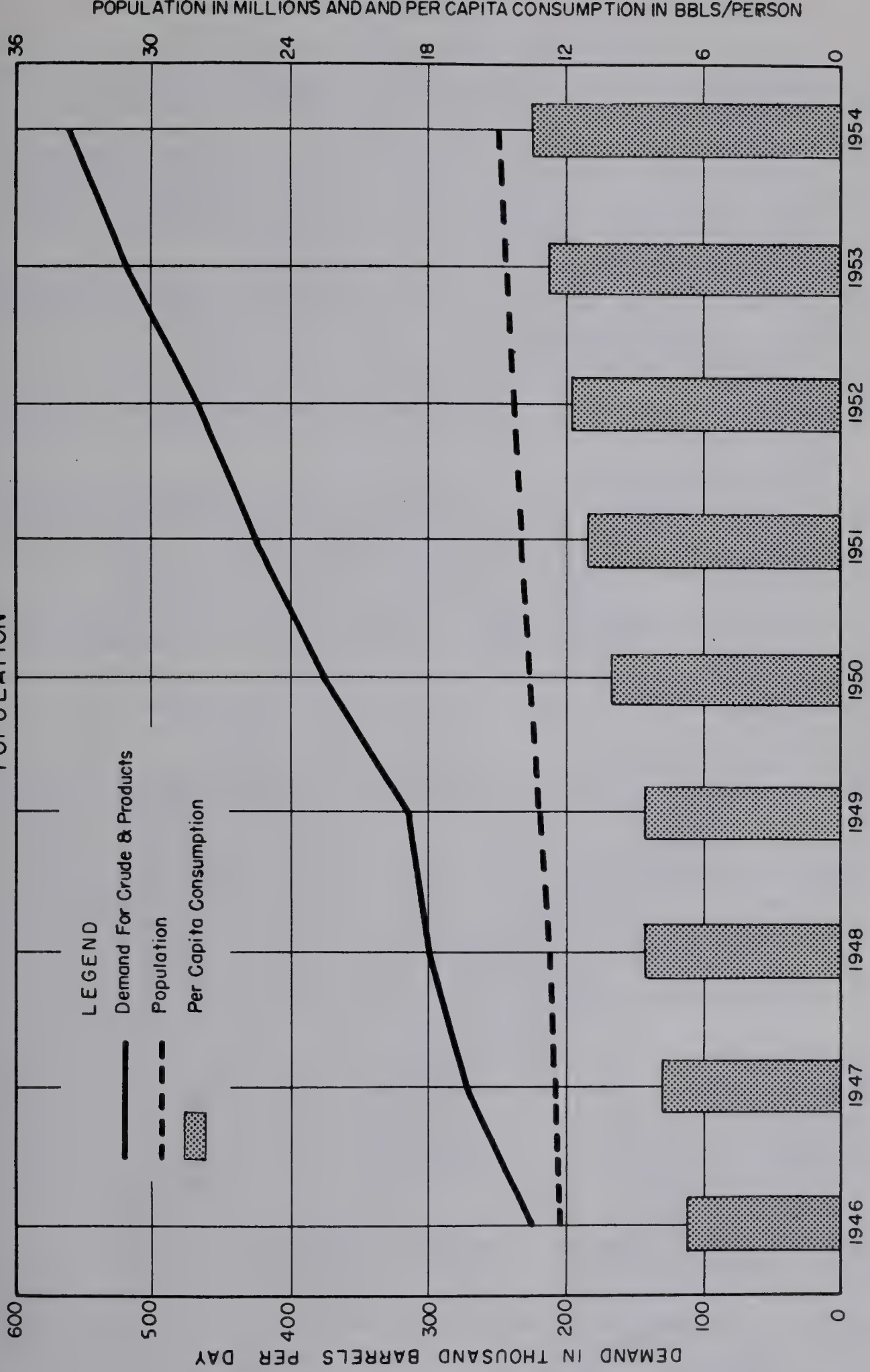
Ratio of reserves to Market Requirements—165.

- (1) The Petroleum and Natural Gas Conservation Board of Alberta. The 1900-1954 Statistical Year Book, Dept. of Mineral Resources, Province of Saskatchewan and other reliable sources.
- (2) The Coke and Gas Industry 1952, Dominion Bureau of Statistics and 1953 and 1954 monthly publications.

CANADIAN DEMAND FOR CRUDE OIL AND PRODUCTS

WITH AVERAGE ANNUAL PER CAPITA CONSUMPTION

POPULATION



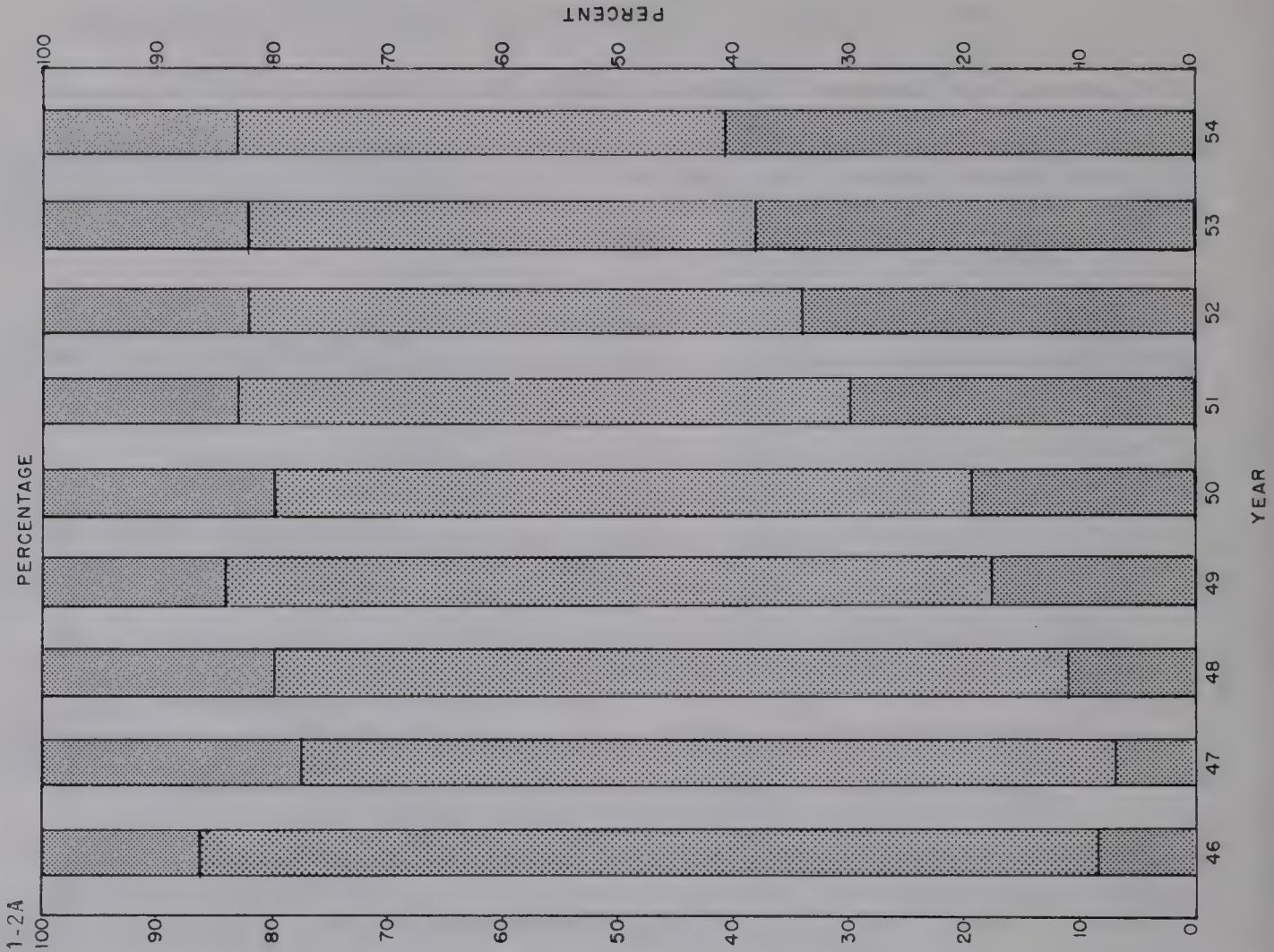
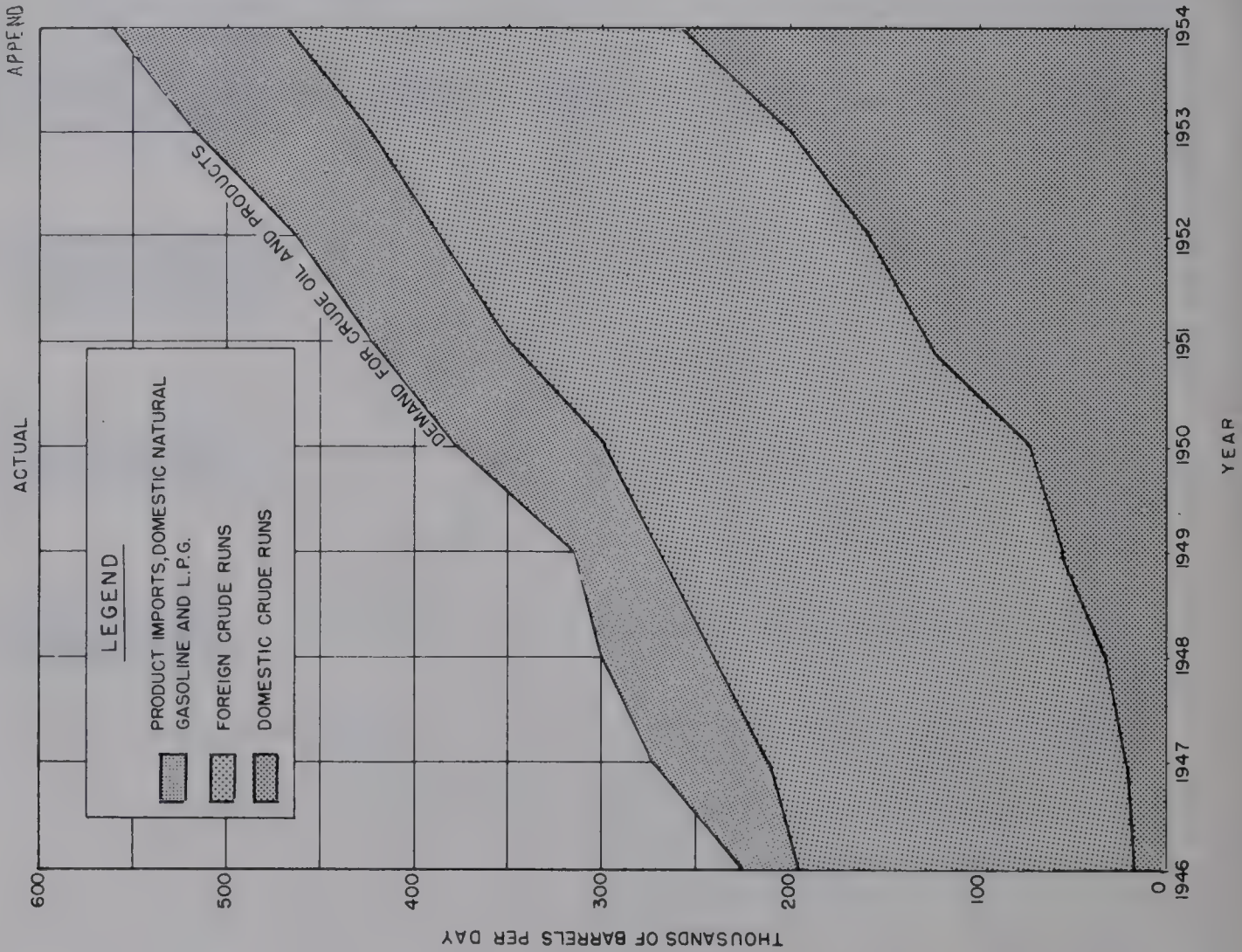
SOURCE: DOMINION BUREAU OF STATISTICS
PREPARED BY: P & N G.C.B. OF ALBERTA

CANADA

DEMAND AND SUPPLY FOR CRUDE OIL AND PRODUCTS

1946 — 1954

APPENDIX 4-1-2A



APPENDIX 4-2

Geology and Reserve Appraisal

Within the Alberta portion of the Western Canada Sedimentary Basin (see Figure 1), an estimated maximum area of 213,500 square miles is underlain by sedimentary deposits which are considered to be favorable for the prospecting of crude petroleum and natural gas. This favorable acreage is composed of approximately 201,600 square miles of the relatively undisturbed and recumbent sedimentary strata underlying the plains area of Alberta, together with approximately 11,900 square miles of the folded and faulted sedimentary strata comprising the relatively narrow foothills belt located to the east and northeast of the mountain ranges. Neither the mountain ranges nor that region of northeastern Alberta covered by less than 1,000 feet of sediments have been included, since both are considered unfavorable for the significant accumulation of crude petroleum or natural gas.

It is evident that there exists an extreme variation in the degree of concentration of petroleum or natural gas reserves beneath specific areas of Alberta. Although it may be expected that the discovery of crude petroleum reserves will increase at a rapid rate within a vast, essentially unexplored, area of western Alberta, the prospects for the discovery of major petroleum fields within much of southeastern, northeastern and northwestern Alberta are not encouraging. Nevertheless, it is expected that the growth of natural gas reserves will continue during the foreseeable future at a significant and relatively uniform rate over much of the plains and foothills areas of Alberta. (Figures 2 and 3 illustrate, in an approximate manner, the continuity and stratigraphic position of the productive formations underlying Alberta.)

An approximate estimate of the total petroleum and natural gas reserves which have accumulated beneath Alberta may be derived by calculating the total volume of favorable sediments underlying the province, and assigning to this volume an average unit accumulation factor calculated, in units of hydrocarbons per cubic mile of sediments, for a comparable basin which has been extensively developed.

The volume of sediments occurring between the base of the glacial drift and the top of the Precambrian granite over the favorable acreage of sediments underlying the plains area of Alberta has been calculated by the Board staff to be approximately 225,000 cubic miles. By assigning a uniform sedimentary thickness of 20,000 feet to the entire foothills belt, an additional 45,000 cubic miles of effective basin sediments have been calculated to exist in Alberta. The thickness of 20,000 feet is considered to represent the economic depth limit for future exploration in the foothills.

Within the United States, there had been discovered, prior to January 1, 1955, a total crude petroleum reserve of nearly 80 (1) billion barrels. On the basis of this reserve, an accumulation factor of 40,000 barrels of petroleum per cubic mile of sediments has been derived as an average for the approximately 2 million cubic miles (2) of effective basin sediments

(1) H. J. Struth, World Petroleum Statistical Year Book, Vol. 1, 1953-54 Edition. A.G.A. and A.P.I., Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas, Vol. 9, December 31, 1954.

(2) L. G. Weeks Concerning Estimates of Potential Oil Reserves, Am. Assoc. Petroleum Geologists Bull., Vol. 34, p. 1947 (1950).

underlying the United States. It is apparent that this accumulation factor will increase as new reserves are discovered. Therefore, for the sedimentary basins of the United States, this accumulation factor may be considered as an absolute minimum value, which is believed, capable of increasing to an ultimate estimate of 55,000 barrels per cubic mile of sediments.

If the minimum accumulation factor, based on the total reserves presently discovered in the United States, is applied to the volume of favorable sediments underlying Alberta, a total potential reserve of 10.8 billion barrels of recoverable crude petroleum is calculated for Alberta. This reserve may be increased to a total of nearly 14.9 billion barrels if the ultimate accumulation factor estimated for the United States is applied to the sediments of Alberta. These reserve estimates refer to total gross volumes of recoverable petroleum, with no deduction made for the petroleum produced during any period.

An estimate of the total reserve of recoverable natural gas capable of being discovered in Alberta can be undertaken by calculating the ratio of the total established gas reserves which have been discovered in Alberta prior to January 1955 (17.62 trillion cubic feet) to the recoverable crude petroleum reserves (2.605 billion barrels) discovered over the same period, and applying this ratio to the ultimate total petroleum reserves derived in the preceding paragraph. This method, based on the improbable assumption that the presently derived reserve ratio of cumulative natural gas to crude petroleum will remain constant, results in an estimated ultimate total discovery reserve of recoverable natural gas ranging between 73.0 and 100.8 trillion cubic feet.

J. R. POW,
P. & N. G. Conservation Board,

October 5th, 1955.

Calgary, Alberta.

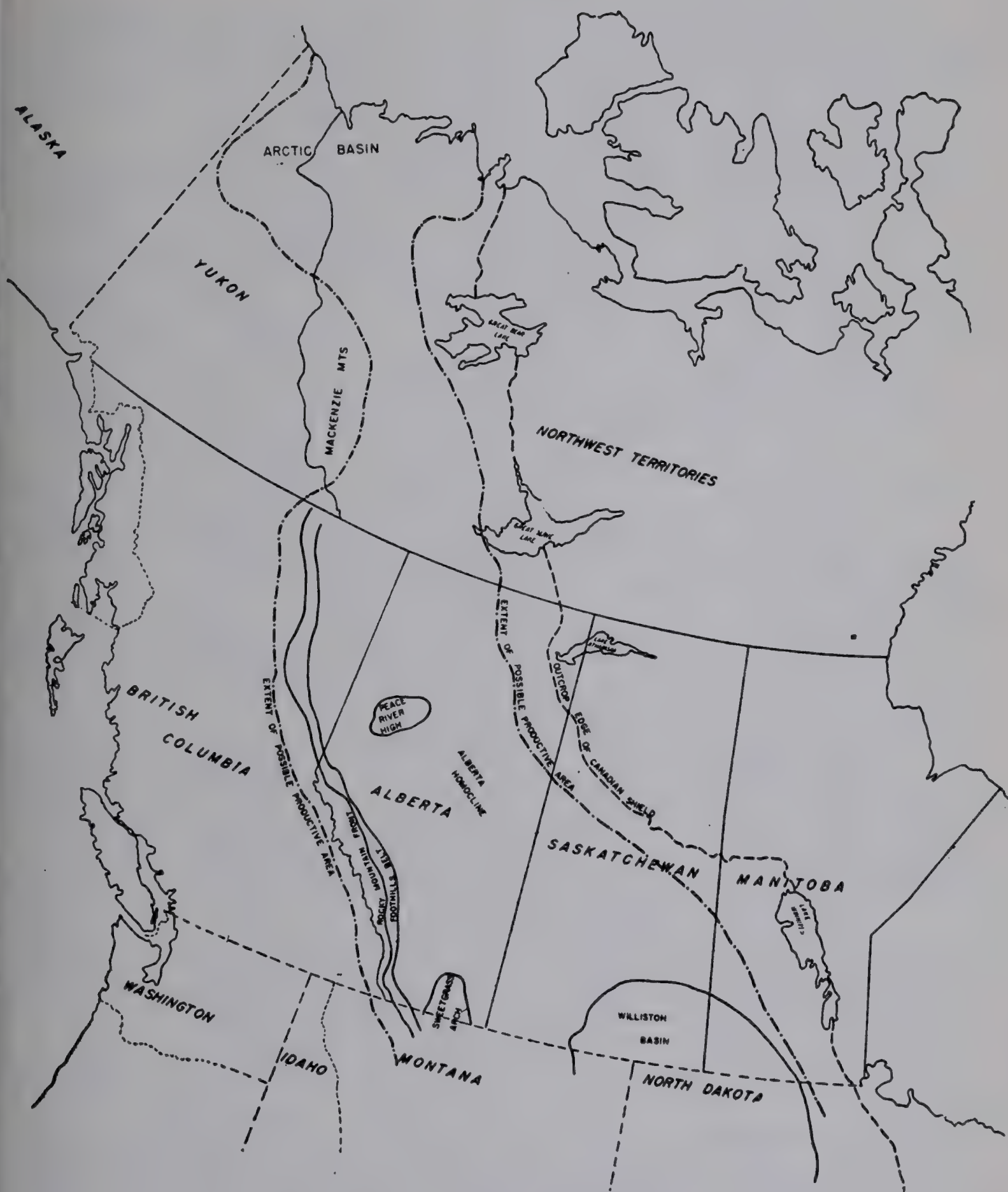


FIGURE
SHOWING
THE WESTERN CANADA SEDIMENTARY BASIN
AND RELATED GEOLOGICAL FEATURES

PERS. OBSERVATION. 1940
GEOLOGICAL SURVEY
MONTANA, 1940

TABLE OF FORMATIONS - ALBERTA

ERA	PERIOD	SOUTHERN FOOTHILLS	SOUTHERN PLAINS	CENTRAL PLAINS	NORTHERN FOOTHILLS	NORTHWEST PLAINS	NORTH PLAINS
CENOZOIC	QUATERNARY	RIVER GRAVEL AND SAND, SOIL GLACIAL DEPOSITS - MORANE, DRIFT, LAKE FILL, ESKERS, KAMES REWORKED OLIGOCENE CONGLOMERATES					
	TERTIARY		CYPRESS HILLS		PASKAPOO	PASKAPOO	
MESOZOIC	UPPER CRETACEOUS	PORCUPINE HILLS WILLOW CREEK ST. MARY RIVER	WILLOW CREEK ST. MARY RIVER BLOOD RESERVE	EDMONTON BEARPAW BELLY RIVER			
		BEARPAW BELLY RIVER	BEARPAW OLDMAN FOREMOST	BEARPAW BELLY RIVER	BRAZEAU	WAPITI	BELLY
		WAPIABI HIGHWOOD SS.	MILK RIVER 1ST. WHITE SPECKS	LEA PARK 1ST. WHITE SPECKS	WAPIABI	WAPIABI 1ST. WHITE SP. BADHEART	1ST. WHITE
		CARDIUM JUMPING POUND SS.	CARDIUM 2ND. WHITE SPECKS	CARDIUM 2ND. WHITE SPECKS	BIGHORN	CARDIUM KASKAPAU 2ND. WHITE SP.	2ND. WHITE
		FISH SCALE ZONE	FISH SCALE ZONE, SS.	FISH SCALE ZONE	BLACKSTONE	DUNVEGAN	FISH
		CROWNEST	BOW ISLAND	VIKING		SHAFESBURG	
	LOWER CRETACEOUS	BLAIRMORE HOME SS. OSTRACOD ZONE DALHOUSE	BLAIRMORE OSTRACOD ZONE BASAL BLAIRMORE (SUNBURST)	BLAIRMORE GLAUC. SS. OST. BASAL QUARTZ SS. MANNVILLE ISLAY DINA	LUSCAR OST. ZONE	PEACE RIVER CADDOTTE HARMON SPIRIT RIVER NOTKIN FALHER WILRICH	LA BICHE 2ND. WHITE FISH
		KOOTENAY				BLUESKY	
						GETTING	
						CADOMIN	
						NIKANASSIN	
						NIKANASSIN	
PALEOZOIC	JURASSIC	FERNIE GROUP BROWN SAND NORDEGG	ELLIS GROUP SWIFT RIERDOON SAWTOOTH		FERNIE GROUP NORDEGG	FERNIE GROUP BROWN SAND NORDEGG	
	TRIASSIC				SCHOOLER CREEK SPRAY RIVER	SCHOOLER CREEK SPRAY RIVER	
	PERMIAN					PERMO-	
	PENNSYLVANIAN					PENNSYLVANIAN	
	MISSISSIPPIAN	RUNDLE GROUP MOUNT HEAD LIVINGSTONE	RUNDLE GROUP LIVINGSTONE	RUNDLE GROUP	RUNDLE GROUP	RUNDLE GROUP	RUNDLE
		BANFF EXSHAW	BANFF EXSHAW	BANFF EXSHAW	BANFF EXSHAW	BANFF EXSHAW	BANFF EXSHAW
	DEVONIAN	PALLISER COSTIGAN MORROW	WABAMUN BIG VALLEY STETTLER	WABAMUN GRAMPA CALMAR NISKU IRETON LEDUC DUVERNAY COOKING LAKE	PALLISER ALEXO MOUNT HAWK PERDRIX FLUME	WABAMUN WINTERBURN WINTERBURN WINTERBURN	WABAMUN WINTERBURN WINTERBURN WINTERBURN
		FAIRHOLME	JEFFERSON	WOODBEND WINTERBURN		WOODBEND WINTERBURN	WOODBEND WINTERBURN
		BEAVERHILL LAKE	BEAVERHILL LAKE	BEAVERHILL LAKE		BEAVERHILL LAKE	BEAVERHILL LAKE
		ELK POINT	ELK POINT	ELK POINT		ELK POINT	ELK POINT
	SILURIAN						
	ORDOVICIAN						
	CAMBRIAN						
	PRE - CAMBRIAN						

THE PETROLEUM AND NATURAL GAS CONSERVATION BOARD

CALGARY, ALBERTA

DECEMBER, 1954

-LEGEND-
GAS
OIL
COAL
CORRELATION UNCERTAIN.....

-NOTE-
No official Conservation Board endorsement is indicated
nomenclature employed by this chart.
Unit divisions and thicknesses have not been drafted to scale
Each unit is depicted from left to right within each column.
The indicated nomenclature and correlation are subject to future

APPENDIX - 4-2
FIG - 4-2-2

APPENDIX 4—2

TABULATION OF THE PRODUCTIVE ZONES AT THE PRODUCING
OIL AND GAS FIELDS IN ALBERTA

Fig. 4—2—3

Field	Producing Zone	Age	Lithology	Hydrocarbon Produced
Acheson	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Acheson East	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
Alliance	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil
Armisie	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
Athabasca	Upper Mannville	Lower Cretaceous	Sandstone	Gas
Barons	Fish Scale Sand	Upper Cretaceous	Sandstone	Oil and Gas
Bashaw	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Battle	Viking	Lower Cretaceous	Sandstone	Oil and Gas
Baxter Lake	Sparky	Lower Cretaceous	Sandstone	Oil and Gas
Black Butte	Swift ("Ribbon Ss")	Jurassic	Sandstone	Gas
	Sawtooth	Jurassic	Sandstone	Gas
Bonnie Glen	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Bonnyville	Second Speckled Shale	Upper Cretaceous	Sandy Shale	Gas
	Colony	Lower Cretaceous	Sandstone	Oil and Gas
Bow Island	Bow Island	Lower Cretaceous	Sandstone	Gas
Brooks	Milk River	Upper Cretaceous	Sandstone	Gas
Campbell	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
Cessford	Basal Colorado	Lower Cretaceous	Sandstone	Oil and Gas
	Basal Blairmore	Lower Cretaceous	Sandstone	Not Producing at Present
Chamberlain	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
Chauvin	Sparky	Lower Cretaceous	Sandstone	Oil and Gas
Chauvin South	Sparky	Lower Cretaceous	Sandstone	Oil and Gas
Clive	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Cold Lake	Colony	Lower Cretaceous	Sandstone	Gas
Conrad	Sawtooth	Jurassic	Sandstone	Oil
Del Bonita	Rundle	Mississippian	Carbonate	Oil and Gas
Dina	Sparky	Lower Cretaceous	Sandstone	Oil
Drumheller	Basal Blairmore	Lower Cretaceous	Sandstone	Oil and Gas
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
Duhamel	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Duvernay	Viking	Lower Cretaceous	Sandstone	Gas
Elk Point	Viking	Lower Cretaceous	Sandstone	Gas
Ellerslie	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
Erskine	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Excelsior	Viking	Lower Cretaceous	Sandstone	Oil and Gas
	Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
Fairydell-Bon Accord	Viking	Lower Cretaceous	Sandstone	Oil and Gas
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Fenn-Big Valley	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Foremost	Bow Island	Lower Cretaceous	Sandstone	Gas
Fort Sask.	Viking	Lower Cretaceous	Sandstone	Gas
Glen Park	Glen Park Ss (Glauc SS')	Lower Cretaceous	Sandstone	Oil and Gas
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Golden Spike	Viking	Lower Cretaceous	Sandstone	Gas
	Basal Quartz Ss	Lower Cretaceous	Sandstone	Gas
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Hamilton Lake	Viking	Lower Cretaceous	Sandstone	Oil and Gas
Joarcam	Viking	Lower Cretaceous	Sandstone	Oil and Gas
Joffre	Viking	Lower Cretaceous	Sandstone	Oil and Gas

**TABULATION OF THE PRODUCTIVE ZONES AT THE PRODUCING
OIL AND GAS FIELDS IN ALBERTA (Continued)**

Field	Producing Zone	Age	Lithology	Hydrocarbon Produced
Jumping Pound	Rundle	Mississippian	Carbonate	Oil and Gas
Leahurst	Basal Blairmore	Lower Cretaceous	Sandstone	Oil and Gas
Leduc-				
Woodbend	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Legal	Viking	Lower Cretaceous	Sandstone	Oil and Gas
Lindbergh	Upper Manville	Lower Cretaceous	Sandstone	Gas
Lloydminster	Sparky	Lower Cretaceous	Sandstone	Oil and Gas
Malmö	"Poplar Ss"			
	(Basal Ss)	Lower Cretaceous	Sandstone	Oil and Gas
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Medicine Hat	Medicine Hat Ss	Upper Cretaceous	Sandstone	Gas
Morinville	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
	Wabamun	Upper Devonian	Carbonate	Oil and Gas
Namao	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
Nevis	Nisku (D-2)	Upper Devonian	Carbonate	Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
New Norway	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Oberlin	Basal Blairmore	Lower Cretaceous	Sandstone	Gas
Peavey	Viking	Lower Cretaceous	Sandstone	Not Producing
	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
Pembina	Cardium	Upper Cretaceous	Sandstone	Oil and Gas
Pendant				
D'Oreille	Bow Island	Lower Cretaceous	Sandstone	Gas
Picardville	Viking	Lower Cretaceous	Sandstone	Gas
Pincher Creek	Rundle	Mississippian	Carbonate	Not Producing
Pouce Coupe	Cadotte	Lower Cretaceous	Sandstone	Gas
Princess	Basal Blairmore	Lower Cretaceous	Sandstone	Oil
	Rundle	Mississippian	Carbonate	Oil and Gas
	Jefferson	Upper Devonian	Carbonate	Not Producing
Red Coulee	Basal Blairmore	Lower Cretaceous	Sandstone	Gas
Redwater	Viking	Lower Cretaceous	Sandstone	Gas
	Basal Quartz Ss	Lower Cretaceous	Sandstone	Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Rimbey	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Rosedale	Basal Blairmore	Lower Cretaceous	Sandstone	Gas
Rycroft	Gething	Lower Cretaceous	Sandstone	Gas
St. Albert	Basal Quartz	Lower Cretaceous	Sandstone	Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
St. Paul	Colony	Lower Cretaceous	Sandstone	Gas
Samson	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
Skaro	Cooking Lake	Upper Devonian	Carbonate	Oil
Smith Coulee	Bow Island	Lower Cretaceous	Sandstone	Gas
Spring Coulee	Rundle	Mississippian	Carbonate	Oil
Stettler	Basal Blairmore	Lower Cretaceous	Sandstone	Oil and Gas
	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Sturgeon Lake	Woodbend Reef	Upper Devonian	Carbonate	Oil and Gas
Sturgeon Lake				
South	Woodbend Reef	Upper Devonian	Carbonate	Oil and Gas
Suffield	Milk River	Upper Cretaceous	Sandstone	Gas
Taber	Taber Sand	Lower Cretaceous	Sandstone	Oil and Gas
Tilley	Milk River	Upper Cretaceous	Sandstone	Gas
Turner Valley	Home Sand	Lower Cretaceous	Sandstone	Oil and Gas
	Dalhousie Sand	Lower Cretaceous	Sandstone	Oil and Gas
	Rundle	Mississippian	Carbonate	Oil and Gas
Vermilion	Sparky	Lower Cretaceous	Sandstone	Oil
Viking-Kinsella	Viking	Lower Cretaceous	Sandstone	Gas
Wainwright	Sparky	Lower Cretaceous	Sandstone	Oil and Gas

**TABULATION OF THE PRODUCTIVE ZONES AT THE PRODUCING
OIL AND GAS FIELDS IN ALBERTA (Continued)**

Field	Producing Zone	Age	Lithology	Hydrocarbon Produced
West Drumheller	Nisku (D-2)	Upper Devonian	Carbonate	Oil and Gas
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Westrose	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas
Whitelaw	Gething	Lower Cretaceous	Sandstone	Gas
	Permo-Penn.	Permo-Penn.	Carbonate	Not Producing (Oil)
Whitemud	Basal Quartz Ss	Lower Cretaceous	Sandstone	Oil and Gas
Wildmere	Colony	Lower Cretaceous	Sandstone	Gas
	Sparky	Lower Cretaceous	Sandstone	Gas
Wizard Lake	Basal Quartz Ss	Lower Cretaceous	Sandstone	Not Producing
	Leduc (D-3)	Upper Devonian	Carbonate	Oil and Gas



5. ATHABASCA OIL SANDS

K. A. CLARK,
Consultant,
Research Council of Alberta.

ATHABASCA OIL SANDS

C O N T E N T S

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5. ATHABASCA OIL SANDS

Oil Reserve

The Athabasca oil sands contain a huge quantity of crude oil that can be exploited when it becomes economically feasible to do so. A commonly quoted estimate of the quantity is between 100 and 300 billion barrels. The difficulty about making the estimate is that the limits of the oil sands are not known. The formation extends over at least 2,500 square miles. Analyses of the many cores that have been cut through the oil sands indicate that an average section of 100 feet containing 6% of oil by weight would be a conservative representation of the situation. On this basis the 2,500 square miles of formation would contain about 150 billion barrels. The figure of 100 billion barrels is sufficiently large to show that the reserve of oil in the Athabasca oil sands is huge. The actual reserve may be considerably larger.

Mining and "In Situ" Approaches

It has been assumed in past thinking about the pattern that oil sand development would follow that the oil sands would be mined by open-pit methods and that the oil would be removed from the mined sand in a separation plant. This assumption was a natural one so long as knowledge about the oil sand formation was derived almost entirely from examination of outcrops in the banks of the Athabasca river and its tributaries. The impression gained from such examination was that the formation consisted of a mineable grade of material throughout most of the section and that the overburden was light. Information about the formation that has been obtained in recent years by exploratory drilling and from other field work makes it obvious that only a small portion of the oil in the formation as a whole is amenable to recovery through the mining approach. The oil content of the average grade of material encountered in the average section through the oil sands is too low for mining. Also, it is only in the immediate vicinity of the rivers that light overburden occurs. An "in situ" method of recovery will be required for getting at the main oil content of the Athabasca oil sands.

Mining and Separation

It should be pointed out at once that the quantity of oil that can be recovered by mining is far from being insignificant. Two areas where high grade oil sand occurs throughout the section and where overburden is light are known. One is the Mildred-Ruth Lakes area that was found and thoroughly examined by the exploratory drilling of the Federal Government. (Drilling and Sampling of Bituminous Sands of Northern Alberta, Vols. I, II, III, Report 826, Bureau of Mines, Department of Mines and Technical Surveys, Ottawa, 1949.) This area is on the west bank of the Athabasca river, about twenty miles downstream from McMurray. It is about 4½ square miles in extent and contains about 900 million barrels of oil. The other area is on the Firebag river in Twp. 98. No drilling has been done on it as yet, but the section is well revealed by exposures along the river. It is estimated that this area contains at least one billion barrels of oil. There are a number of other smaller mineable areas.

The technology of mining oil sand and then recovering the oil in a separation plant is quite well understood. Although mining has not been

done to date except on a small scale, it is considered that the experience in large-scale open-pit mining of other materials can be adapted to the oil sands. The recovery of oil from the mined sand is accomplished, readily, by the hot-water-washing method. Several small plants have demonstrated the workability of the method. The only problem involved is the design of equipment that is mechanically reliable. The Government of Alberta built a well engineered plant at Bitumount and operated it successfully during 1949. It handled about 500 tons of oil sand per 24 hours.

The "Blair" Report

The oil contained in the oil sand is low in grade compared to the crude oils obtained from most of the Alberta oil fields. It is very viscous and contains about 5% of sulphur. However, the oil refining industry has developed processes that will convert it into a high yield of gasoline and other fuels.

The Government of Alberta made a thorough engineering study of the whole sequence of operations that would make up a complete oil sand development, estimated the cost of producing a saleable product delivered to the Great Lakes market and evaluated the selling price of this product. The findings of the study were published in a "Report on the Alberta Bituminous Sands. S. M. Blair associated with Bechtel Corporation and Universal Oil Products Company, Government of Alberta, 1950". This report is commonly called "The Blair Report". It was received by the oil industry with much interest and was widely distributed. The sequence of operations chosen for a complete development were: open-pit mining of the oil sand; separation of oil from the mined sand by the hot-water-washing method; coking of the crude separated oil by the fluidized solids technique to produce a pumpable cracked distillate; desulphurization of the cracked distillate by mild hydrogenation; transportation of the desulphurized oil to market by pipeline. The product to market was a mixture of about 15% naphtha and 85% of a product approximating No. 2 furnace oil. The total cost of producing this product and delivering it, on a minimum scale of 20,000 bbl./day, was estimated to be \$3.10 per bbl. Its selling price was appraised at \$3.50 per bbl.

Oil sand that would be mined contains about 13% by weight of oil. The recovery of oil from this sand by the hot-water-washing process is 90%. When coked, the recovered crude oil yields around 85% of cracked distillate. There is no loss of volume involved in the desulphurization. As a general statement it can be considered that a cubic yard of mined oil sand will yield a barrel of marketable oil.

The reason for the great interest shown the Blair Report was its finding that oil sand development was a present-day possibility. The existence of the Athabasca oil sands was well known throughout the oil world, but thinking about them was that they were an oil reserve for development at some time in the indefinite future. The Blair Report placed them on the doorstep of the oil industry for immediate attention.

The Oil Sands Conference

The Government of Alberta sponsored an oil sands conference at Edmonton during 1951. It was attended by about 125 representatives of the technical staffs of oil companies and other scientists closely associated with the industry. The geology of the oil sand formation, oil sand mining, recovery of oil from the mined sand, refining and pipelining were discussed. The Government of Alberta formulated its policy for oil sand development

and announced, at the conference, its terms for prospecting, leasing and levying of royalties. The proceedings were published under the title "Proceedings, Athabasca Oil Sands Conference, Sept. 1951". Copies are obtainable from the Board of Trustees, Oil Sands Project, Government of Alberta, Edmonton. These proceedings and the Blair Report are the main references regarding the practical aspects of oil sand development.

Exploration

The oil sands conference was followed by the taking of permit areas by the oil companies for oil sand exploration. During 1952, 11 such areas of about 50,000 acres each were taken and several more have been taken since then. About 200 holes were drilled on them for determining the character of the oil sand cross-sections and for samples for analyses. The reports on this exploratory drilling are held by the government in confidence. Exploration has ceased on most of the areas and the permits have been dropped. Leases on parts of the areas have been taken in nine cases.

The Government of Alberta offered its separation plant at Bitumount and an adjoining lease of 5874 acres for sale. The plant and lease were bought by Can Amera Oil Sands Development Co. The company has announced plans for proceeding to commercial development. Mining and a separation method of its own are to be used.

"In Situ" Recovery

As has been mentioned, most of the oil in the Athabasca oil sands occur under conditions that make mining inapplicable. These conditions are a cross-section showing much shale interbedded with the oil sand thus reducing the average oil content and excessive overburden. The only apparent way of overcoming these conditions is to devise means for causing the oil to flow into drill holes. It will not do so, as in wells in ordinary oil-fields, because of the very viscous character of the oil and of the absence of gas pressure.

The mixed up nature of the cross-section through the oil sands is what would be expected in view of the way in which the deposit accumulated. Presently available information indicates that the sediments of the oil sand deposit were derived from erosion of the Precambrian rocks and of the Athabasca sandstone lying to the east in Lower Cretaceous times. Sand, silt and clay were carried westward by rivers and streams and were spread out on a continental slope extending into a sea. The order of deposition of these materials was most erratic and was changeable as the drainage system changed over a long period of time. At any one location the succession of material piled up would be shale, sand or interbedded shale and sand depending on sedimentation conditions from time to time. Lateral variation would be pronounced. Where rivers flowed into the sea there would be deltas. Also, during the period in which the deposit was formed the land was sinking and the sea to the west was encroaching on the accumulation of sediments. Thus, the top of the oil sand sections is marine while the rest is mainly of fresh water deposition. It can be understood, from this picture, why a cross-section through the oil sand formation is so variable and why there are so few locations where all or most of the section consists of sand.

The source of the oil in the oil sand is still a much debated question. Wherever it came from, when it entered the deposit it filled the voids in

the sand beds quite completely making good grade oil sand of around 13% of oil by weight depending on the porosity and a few percent of water content. Water was displaced from silty or clayey sand less completely and the oil penetrated shale very little or not at all. Examination of the logs and core analyses of many drill holes indicates that, on the average, a section consists of about one-third good grade oil sand in beds five feet or more thick, one-third interbedded oil sand and shale of about 6% oil content and one-third barren shale. The oil sand section along the Athabasca river is generally between 150 to 200 feet thick. Variations in thickness are due to the topography of the Devonian limestone or shale floor on which the deposit rests.

The overburden over the oil sands in the vicinity of the Athabasca river below McMurray consists of loose material of Pleistocene or recent origin. Further away, the Clearwater marine shales that were deposited over the oil sands are present. On high ground, such as the Birch Hills to the west of the Athabasca river, succeeding formations occur. Overburden conditions on the area of 2500 square miles over which the oil sands undoubtedly extend are, approximately as follows:

0 - 150 feet of overburden	800 square miles
150 - 500 " " "	800 " "
500 - 1000 " " "	900 " "

From this summary it can be seen that, quite apart from the erratic nature of beds making up the oil sand section, excessive overburden makes mining impracticable for most of the oil sand area.

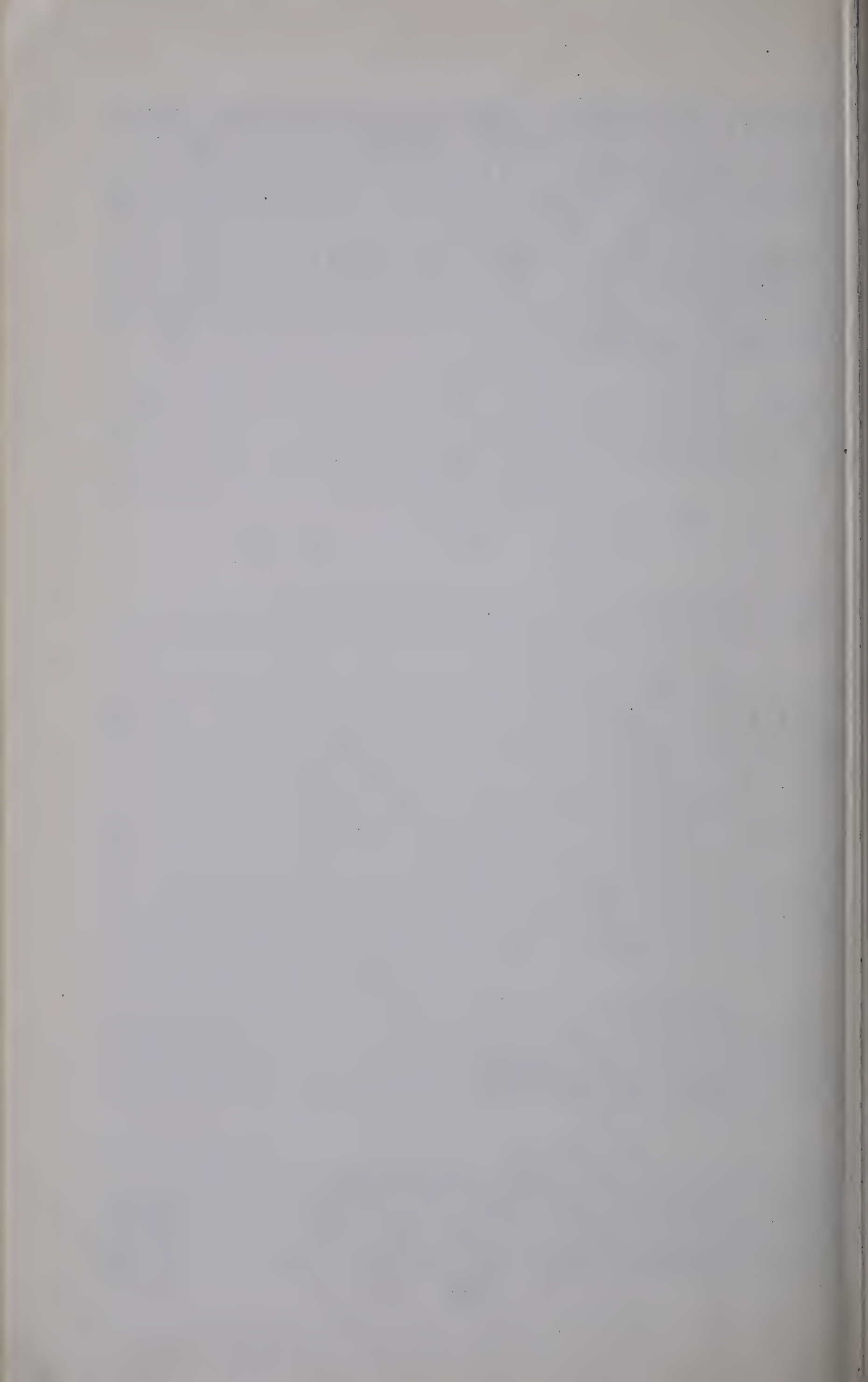
Progress is being made with the development of an "in situ" method applicable to the general oil sand situation. The Magnolia Petroleum Company has published encouraging information about its work on underground combustion. (Kuhn, C. S. and Koch, R. L. Oil and Gas Journal 52 No. 1492 (1953). The procedure is to drill holes into the heavy oil formation and to establish communication between them by applying air pressure. Then the oil sand is ignited at the face of alternate holes and combustion is maintained by controlled addition of compressed air. Oil and water vapors are driven forward before the fire front carrying heat to make the viscous oil more fluid and to thin it by dilution with the condensed oil vapor. The fire is maintained by the coke that remains on the sand when the heavy oil is destructively distilled. A mixture of the formation oil and cracked distillate is forced into the production holes. The method has been tested in the field on an actual heavy oil reservoir and results were sufficiently encouraging to justify further trials.

The average mixed Athabasca oil sand section made up of interbedded oil sand and shale of 6% oil content along with beds of better grade material should be suitable for the application of this "in situ" combustion method of recovery. A 6% oil content is probably as great as that in most oil fields developed by conventional drilling. Overburden is desirable since it allows the use of pressures in proportion to overburden thickness.

Economic Outlook

The urge to find further sources of crude oil is variable. It was strong when the Blair Report was issued and the oil companies gave serious thought to the possibilities of oil sand development. However, because of increasing discoveries of oilfields in Alberta, the interest has fallen. The present outlook is that so long as Alberta crude oil production continues

to grow and the problem of finding market outlets for this oil persists, there will be little incentive to bring on oil sand development. The oil sand reserve is there, however, to be turned to when needed. Enough is known about the Athabasca oil sands and how to deal with them to allow of quite prompt development when their time arrives. The mining approach will probably be the first to be used followed by the main development by "in situ" methods. The oil industry is awake to their potential importance to oil supplies for the future and study is being given to them constantly although leisurely. How soon it will be before oil from the oil sands will be wanted is difficult to predict. The demand for oil on this continent is growing at a rapid rate and the glut of supplies in Alberta could disappear much sooner than can be foreseen now.



6. ELECTRICAL ENERGY

J. G. MacGregor, Chairman, and
J. L. Reid, Secretary,
Alberta Power Commission.

ENERGY RESOURCES OF ALBERTA

ELECTRICAL ENERGY

SUMMARY

1. Potential hydro sites on Alberta's rivers could add 2,850,000 K.W. to the generating capacity of the Province. This would add $42,600 \times 10^9$ b.t.u. to the pool of energy resources. We do not expect to see all of this power developed during the forecast period.
2. It is estimated that Alberta's use of electrical energy will increase from 1,630 K.W.H. per capita in 1955 to 4,760 K.W.H. per capita in 1985.
3. This will increase Alberta's demand for electrical power from 1,676 million K.W.H. generated in 1955 to 8,640 million K.W.H. in 1985.
4. No import of power to the Province is expected during the period under review and the only possibility of exporting power is to the mining areas of northeastern Saskatchewan or to the southern Northwest Territories.
5. The percentage of power generated by hydro, gas and coal in 1955 is expected to be 57%, 40%, and 3%, respectively, while in 1985 these percentages are expected to be 46%, 12%, and 42%.
6. The difference in the cost of producing a K.W.H. at present by hydro, gas-fired steam plants, coal-fired steam plants, or gas turbine plants, is so small that there is no clearcut indication of which type of generation would be chosen when consideration is given to building a new plant.
7. We believe that over the forecast period the price of gas may increase. After it does future steam plants will be fired with coal.
8. We expect the consumption of energy by the Central Station Industry to increase from $13,000 \times 10^9$ b.t.u. in 1955 to $77,000 \times 10^9$ b.t.u. by 1985.
9. We do not expect to see any electricity generated in Alberta by nuclear plants before 1975 at the earliest because it will take at least that long before improved technology will reduce the cost of nuclear power so as to make it competitive with power produced by our low cost fossil fuels.

INTRODUCTION

The Central Station Industry in its use of energy resources acts in a dual capacity. In the first place, by its production of electricity from hydro sites it adds to the pool of energy resources, some energy that could not otherwise be utilized in any practical manner. On the other hand, it depletes the pool of energy resources by its conversion of fossil fuels or of fissionable material to electric energy which in turn is consumed by its customers.

Production of Energy Source Materials

Let us deal first with the production of electricity from potential hydro sites. At December 31st, 1954, the total developed hydro power in Alberta was 204,000 K.W. This represented 49.6% of the total generating capacity of the Province. Except for a very minor plant on the Athabasca all of this development has taken place on the Bow River, west of Calgary.

Our practical undeveloped hydro sites are on the Bow River or on rivers north of it. Except for the Bow River, which is also used for irrigation, the rivers in the southern part of the Province are now being used for irrigation purposes, which require headwater storage for summer use and, therefore, limits their use for hydro power.

The Dominion Water and Power Bureau, in its 1949 Report on Alberta's available 24 hour power at 80% efficiency and at ordinary 6 months' flow, estimated the Province's potential hydro power as 1,258,000 H.P. (1), or about 950,000 K.W. It has long been recognized that the surveys of forty years ago, from which this figure was obtained, were based on a conception of the methods of using rivers for developing power which has now become outmoded. With modern ideas of creating artificial storage, the hydro possibilities of our rivers has been greatly expanded.

The following estimates, which have been compiled by the Provincial Water Resources Branch, are based on the modern concept of hydro power. The undeveloped water power capacity of our rivers is as follows:

Investigated Sites	K.W.	K.W.
Bow River	300,000	
North Saskatchewan River	300,000	
	600,000	600,000
Partially Investigated Sites		
North Saskatchewan River	150,000	
Athabasca River	1,600,000	
Peace River	50,000	
Slave River	450,000	
	2,250,000	2,250,000
		2,850,000

While there is an estimated 2,100,000 K.W. on the Athabasca, Peace and Slave Rivers, only 1,100,000 K.W. of this is accessible to the Edmonton area, while 1,000,000 K.W. of it is from 300 to 600 miles away from Edmonton. Three possibilities exist for the practical utilization of this 1,000,000 K.W. from these distant sites.

(1) Canada Year Book

1. Developing industries near the source of power.
2. Exporting the power to the mining areas of the southern Northwest Territories and of northwestern Saskatchewan.
3. Transmission of this power to the Edmonton area.

We are not competent to discuss the first alternative. The development of the tar sands may produce a market for this power.

The question of exporting power to the northern mining areas is discussed more fully later in the report.

Transmitting this power to Edmonton is a possibility which, at the moment, appears to be somewhat remote. The following quotation is taken from "The Electric Power Industry in Canada", issued by the Department of Defence Production at Ottawa in February, 1953:

"Water power resources which are not too remote, however, need not always wait for purely local markets. Still higher voltages are expected by many in the industry to extend the radius of economic transmission to something like 600 miles within the next decade, if Swedish experience may be trusted. This, together with economies resulting from the greater integration of existing power systems and the use of steam plants during periods of peak demand, will bring some relief to these consuming areas which would otherwise be faced with the generally higher costs associated with thermal generation of electricity".²

This may be true, but there are many engineers who have been disappointed at the progress made in long distance transmission during this past 25 years. Direct current transmission has been held out as a hope, but in it, too, progress has been very slow. At the present stage of technological development the cost of transmitting power in large blocks for two hundred miles is about 2 mills per K.W.H. As the distance increases the cost varies somewhat as the square of the distance, so that it appears that it may be quite costly to transmit power much beyond 300 miles.

In short, while approximately 1,000,000 K.W. of undeveloped water power is available from the Slave and on the lower reaches of the Peace and the Athabasca, it is not likely to become a factor in Alberta's utilized energy resources unless some of it is used for export or in the development of the tar sands, but it is quite likely that the processing of these sands will produce enough power for its needs from its by-products. In the presently populated areas of Alberta coal, natural gas and even nuclear power will undoubtedly be used instead of developing these northern hydro sites. If, however, the economic situation becomes such that it ever becomes advantageous to cut off these other sources of power, and to utilize this hydro, it could be done.

For the purposes of this report, then, it appears that we need not consider the 1,000,000 K.W. just mentioned. Without this there is approximately 1,850,000 K.W. of hydro power accessible to the populated areas of the Province, even though 2,850,000 might be considered to be the ultimate possible development of hydro power. The cost of producing power from one of our lower cost hydro sites is not cheaper than the cost of producing it from fossil fuels. For this reason, it is even doubtful if the 1,850,000 K.W. of accessible power will all be developed during the next 30 years.

If we assume a load factor of 50% on these potential hydro sites we arrive at the following estimate of energy from them. In other words, this

(2) "The Electric Power Industry in Canada"—Dept. of Defence Production, 1953.

is the possible energy which the Central Station Electric Industry could make available to be added to our pool of energy resources.

Undeveloped Hydro Sites

	K.W.	K.W.H.	B.T.O.
(a) within economic reach	1,850,000	8,103,000,000	27,647 x 10 ⁹
(b)	1,000,000	4,380,000,000	14,944 x 10 ⁹
	2,850,000	12,483,000,000	42,591 x 10 ⁹

Consumption of Energy Sources Materials

Dealing with the probable consumption of energy source materials by the Central Station Electric Industry, we have made the estimates which follow:

The future power requirements of the Province resolve themselves into a question of population. To arrive at the future power requirements of the Province we must first estimate the population and then try to estimate the increase in K.W.H. generated per capita. The Provincial Bureau of Statistics has made the following forecast of population growth:

Projected Population Growth for Alberta

1955	1,028,000
1960	1,143,000
1965	1,253,000
1970	1,376,000
1975	1,517,000
1980	1,675,000
1985	1,850,000

Assuming an increase in population, it is next necessary to estimate what will be the increase in K.W.H. generated per capita. Our studies have led us to predict the following K.W.H. per capita:

1955	1,630
1960	1,980
1965	2,400
1970	2,910
1975	3,400
1980	3,950
1985	4,670

It may be interesting to compare this with the K.W.H. per capita in 1951 for all the Provinces in Canada.

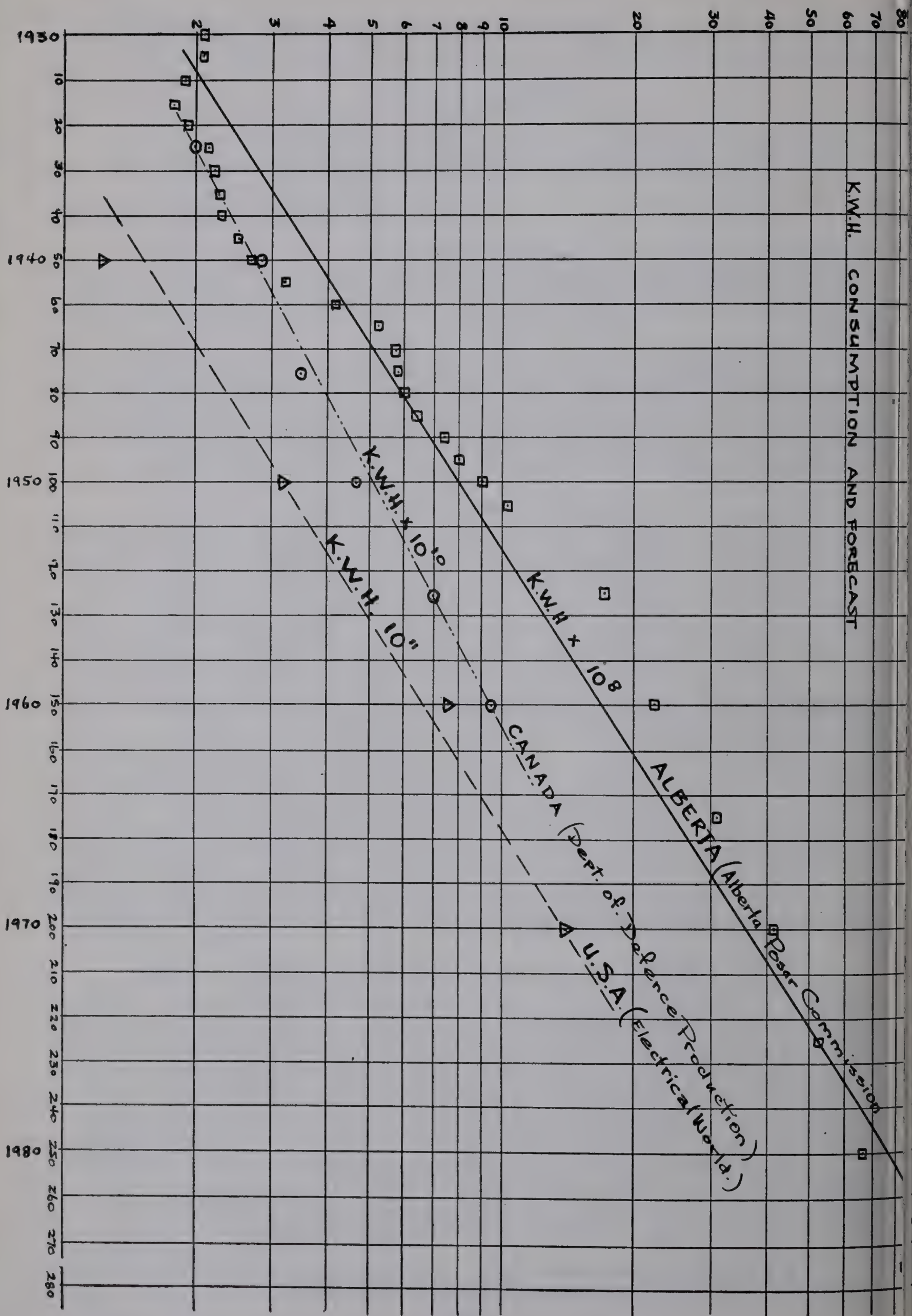
Quebec	5,940
Ontario	4,470
Manitoba	3,760
British Columbia	3,590
New Brunswick	1,390
Nova Scotia	1,360
Alberta	1,090
Saskatchewan	550
Newfoundland	350
Prince Edward Island	240

The increase in K.W.H. per capita for Canada as a whole in the ten-year period shown below is 54% and is as follows:

1941	2,400 K.W.H. per capita
1951	3,700 K.W.H. per capita

We merely present these figures for what they are worth but are not prepared to draw too detailed conclusions from them.

K.W.H. CONSUMPTION AND FORECAST



With this compounding of estimates upon other estimates we have arrived at the K.W.H. to be generated in Alberta as shown in the table below:

Year	Pop. x 10 ³	K.W.H. per capita	Total K.W.H. x 10 ⁶
1955	1,028	1,630	1,676
1960	1,143	1,980	2,263
1965	1,253	2,400	3,007
1970	1,376	2,910	4,004
1975	1,517	3,400	5,158
1980	1,675	3,950	6,616
1985	1,850	4,670	8,640

Chart No. 1 shows the K.W.H. generated in Alberta since 1930 and our projection of this into the future. We have also drawn on this chart two other forecasts. One is that made by the "Electrical World" of the K.W.H. to be generated in the U.S.A. (3) The other is a 1953 forecast of the Department of Defence Production of Canada already cited. Our forecast of the rate of increase is approximately the same as that of the "Electrical World" for the United States, and is higher than that of the Department of Defence Production for Canada. We believe that our rate of increase will be higher than that of Canada as a whole, principally because we are starting so much further down the scale, and in 1951 had a K.W.H. per capita of 1090 compared to 3700 for all of Canada.

The above estimates of K.W.H. generated are for our Provincial requirements assuming no import or export of power. We believe that any import or export is unlikely during the forecast period.

The only possibility of import is from British Columbia and that will be if and when the hydro sites on the Columbia River are developed. These have been estimated at a possible 3,000,000 K.W. At some stages of development power may be available to Alberta for periods of two or three years at a time, but British Columbia will ultimately need all this power so that any export to Alberta will be temporary.

On the question of export there appear to be three possibilities, but only one probability, and that rather remote.

1. Export to U.S.A. Some studies have been made as to the possibility of generating power from our coal fields in the Crowsnest Pass and exporting this to The Northwest Power Pool in Montana, Idaho, Washington and Oregon. In spite of tremendous hydro resources in those states it appears possible that these will all be developed within the next 10 years or so. When that point is reached it will be necessary to supplement the power resources of this region. One possibility is the export of power from Alberta and southern British Columbia. One barrier to this is the high cost of transmission. It appears, however, that with the strides being made in the production of power from nuclear energy the requirements of this region may be met by nuclear plants.

2. Export to the presently populated areas of Saskatchewan. This, too, appears unlikely, particularly since any power thus exported would be generated by coal-fired steam plants located in the west central portion of the Province. This power would have to be transported a considerable

(3) "Business and Economic Charts"—Ebasco Services Incorporated, Dec. 1954.

distance east through an area of very sparse population before reaching the load centres of Saskatchewan. It appears to us more likely that Saskatchewan will always generate enough power to meet its own requirements either from its coal fields in the Estevan area or from its numerous natural gas fields.

3. Export to the base mining areas of northwestern Saskatchewan or in the Northwest Territories. Undoubtedly, as these mining areas commence to be developed there will be a large demand for power. Another possible market is in the Goldfield area of Saskatchewan which is a major and an expanding producer of uranium concentrates. The primary production of uranium ore requires substantial amounts of energy and if a refinery should be established more energy will be needed. Much of this will be obtained along the Slave River in the Northwest Territories. A great deal more will be obtained from hydro power in northwestern Saskatchewan, but this may still leave a certain amount of it to be generated in Alberta and transmitted to the load centers. Any power so generated will be using the 1,000,000 K.W. of potential water power which, as we stated above, is located on the lower reaches of the Peace, the Athabasca and on the Slave Rivers. If this 1,000,000 K.W. of power should be generated in the northeastern corner of the Province for export it is likely that this is the only way in which this power will be used, unless some of it is used in the development of the tar sands.

In view of the above we tend to discount export or import of power and to consider that all the electric power generated in the Province will be used in Alberta.

Having estimated the K.W.H. to be generated in Alberta, the next problem is to estimate how much of our abundant energy resources will be used in its production. In making such a forecast it should be kept in mind that the difference in cost of a K.W.H. delivered to the load-consuming areas of the Province from a hydro plant, a coal-fired steam plant, or a gas-fired steam plant, is so small that there is little to choose between them. The matter of a few thousand dollars one way or another in investment or of a mill per K.W.H. in cost of power delivered will be the deciding factor in which of the three alternative types of plants is built at any particular time to supply any particular load. There is no clearcut advantage of one over the other that makes it possible to say with assurance that for the next ten years, for instance, all the plants will be hydro, or that they will be gas-fired or that they will be coal-fired. This being so, making such a forecast resolves itself into a matter of opinion.

The following are our opinions:

1. The growth of the electric load in the Province is about 30,000 to 40,000 K.W. per year. We have, therefore, reached the point where future power plants will be built in units of 30,000 or 60,000 K.W., and will be expanded by adding duplicate units of the same size. Fuel burning plants, therefore, will be large enough that they will warrant the greatest refinements in fuel utilization and conservation.

2. For the next few years existing steam plants such as those in the Cities of Edmonton, Lethbridge, Medicine Hat and Vermilion will install more gas-burning equipment because the present arrangement, design and economy of the plants will warrant them so doing.

3. Plants built in new locations will be coal-burning and will be built where coal can be strip-mined, delivered to the plant by conveyor belt, pul-

verized and blown into the furnaces. The main requirements to be met in choosing sites for these plants will be those of having adequate resources of coal and ample cooling water. These requirements can be met near such lakes as Wabamun or by damming up rivers that pass through seams of coal so as to provide cooling water, or a possible combination of hydro and coal-fired plants when the latter will use the storage reservoirs for cooling purposes.

4. We believe that the cost of strip-mined coal for these plants will not be affected by inflationary tendencies to the same extent as most commodities because the labour cost per b.t.u. will be quite a small factor.

5. We believe that natural gas will increase in price at a faster rate per b.t.u. than such strip-mined coal.

6. For this reason we believe during most of the forecast period the power companies will tend to build coal-fired plants in preference to gas-fired. It is possible that if there should be distress gas available near such coal-fired plants it might be used in them for short periods, or to take some part of the load.

Chart No. 2 shows our estimate of the total K.W.H. to be generated and the portions of this which will be generated by hydro, natural gas and coal. A very small fraction will be generated by fuel oil in isolated internal combustion plants but this fraction is so small that we have left it off our chart. Table No. 1 shows the K.W.H. which we think will be generated by these different sources of energy and also shows the b.t.u. to be extracted from the pool of energy resources to produce this electricity.

As we pointed out in the section of this report dealing with developing additional hydro plants, all of the energy made available from these hydro plants adds to our store of energy. When we consider the utilization of all the energy produced in all our different types of generating plants, as we are doing here, all of this energy is being subtracted from our total energy pool. In the case of electricity generated by hydro it is necessary in this part of the report to subtract from our energy pool all of the energy added by hydro in the previous part of the report. For this reason, in dealing with K.W.H. generated by hydro, we are converting this to b.t.u. on the basis that there are 3,412 b.t.u. in a K.W.H.

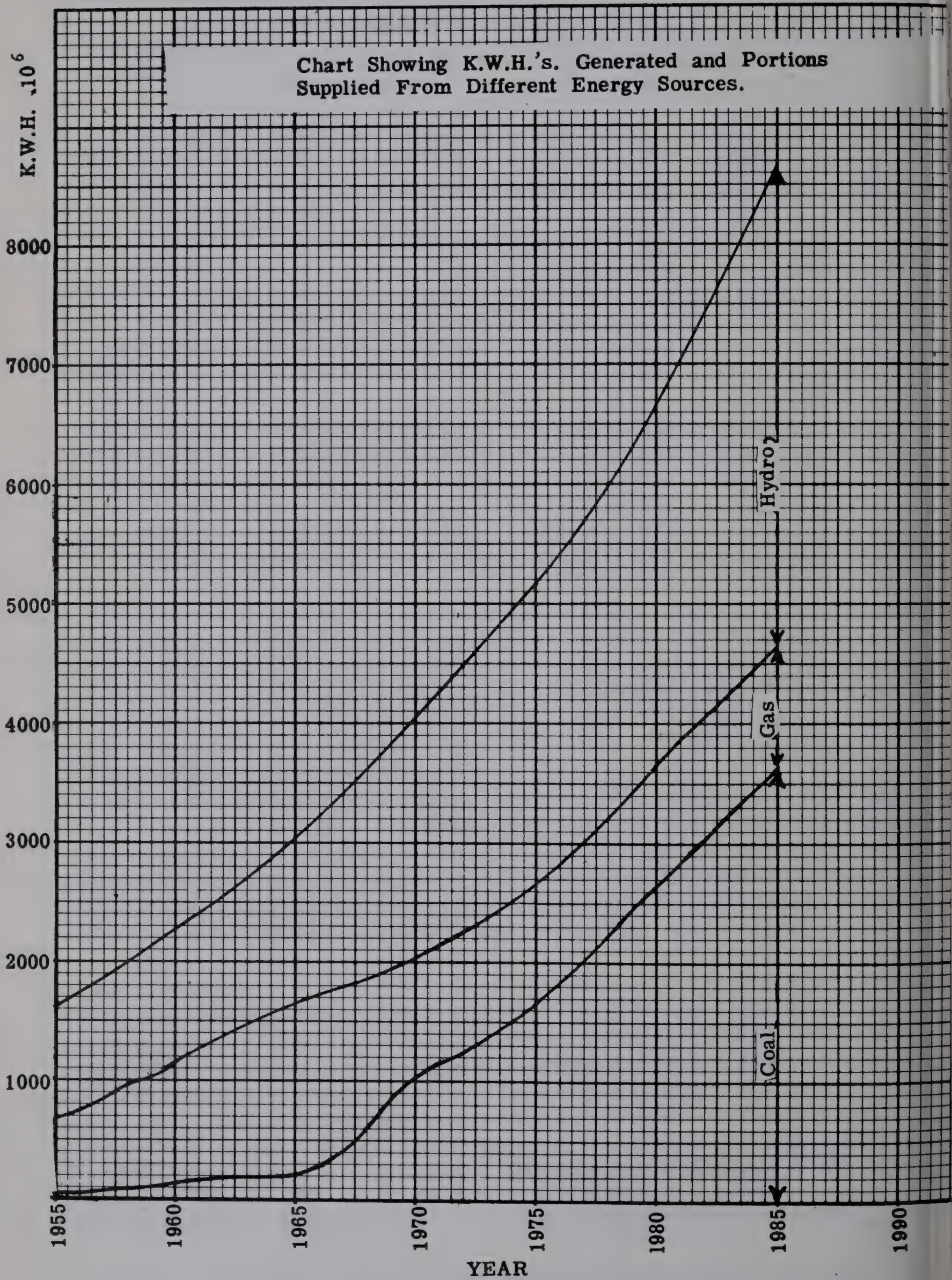
When, however, we are dealing with K.W.H. generated by fossil fuels, while there are still 3,412 b.t.u. in each K.W.H., nevertheless, due to the low efficiency of conversion from fuel to electricity, it is necessary to supply four or five times as many b.t.u. in the fuel as are available in the K.W.H. generated.

Dealing with generation using natural gas as a fuel, Professor Christie, in a recent report, made some estimates on a 60,000 K.W. gas-fired plant in Alberta. (4) He estimated that it would take 12,688 b.t.u. per K.W.H. generated, net, or about 13.35 cubic feet of gas per K.W.H. delivered to the buss-bar. Such an efficient use of fuel would be possible only in a new plant designed for fueling with natural gas. Many of our gas-fired plants are not new and are using from 15.1 cubic feet of gas to 19.3 cubic feet of gas per K.W.H. generated, net. Recently, a small gas turbine was installed in the Province and plans are now being made to install two additional large gas turbines. It is likely that these will use something of the order of 20 cubic

4 "Power Development for Edmonton"—A. G. Christie, 1952

CHART CHART #2

Chart Showing K.W.H.'s. Generated and Portions Supplied From Different Energy Sources.



**ESTIMATE OF MILLIONS OF K.W.H. GENERATED NET UNTIL 1985, SHOWING
AMOUNTS TO BE GENERATED FROM THE VARIOUS FUELS AND THE
CONSUMPTION OF EACH FUEL EXPRESSED IN b.t.u.**

Year	Total KWH	KWH by Hydro	b.t.u. x 10 ⁹ consump- tion (KWH x 3412)	KWH by natural gas	b.t.u.x10 ⁹ consump- tion (KWH x 14526)	KWH by coal	b.t.u.x10 ⁹ consump- tion (KWH x 13500)	KWH by fuel oil	b.t.u.x10 ⁹ consump- tion (KWH x 10500)	Total b.t.u.x10 ⁹ consump- tion
1955	1,676	975	3,330	645	9,369	50	675	5	53	13,427
1960	2,263	1,100	3,753	1,035	15,034	123	1,674	5	53	20,514
1965	3,007	1,400	4,777	1,435	20,845	167	2,255	5	53	27,930
1970	4,004	2,000	6,834	1,000	14,526	999	13,487	5	53	34,900
1975	5,158	2,500	8,530	1,000	14,526	1,653	22,316	5	53	45,425
1980	6,616	3,000	10,236	1,000	14,526	2,611	35,249	5	53	60,064
1985	8,640	4,000	13,648	1,000	14,526	3,635	49,073	5	53	77,300

feet of gas per K.W.H. For the purposes of this report, taking into account old and new gas plants and gas turbines, we have used the figure of 18 cubic feet of natural gas at 957 b.t.u. per cubic feet.

For a similar 60,000 K.W. coal-fired plant Professor Christie estimated that it would take 13,246 b.t.u. per K.W.H., or 1,656 pounds of coal per K.W.H. based on using coal of 8000 b.t.u. per pound. Since, in the future, nearly all of our electricity generated by coal will be in large new plants, we are using the figure of 13,500 b.t.u. per K.W.H.

Only a fraction of the output of power is generated by fuel oil used in diesel engines and this averages about 10,500 b.t.u. per K.W.H.

Various statements have been made so far in the report about developments that may have the effect of substituting one fuel for another. As we have said, the costs of generating a K.W.H. from hydro, gas or coal-fired steam plants, or gas turbine plants, are so very nearly equal that a variation of one mill per K.W.H. or a few dollars per K.W. of installed capacity will be the deciding factor when any particular plant site or method of generation is under consideration.

The capital investment in plants is greatest in hydro and decreases through coal-fired steam plants, gas-fired steam plants to gas turbine plants, in that order. Operating costs are greatest in coal-fired plants and decreases through gas-fired, gas turbine and hydro, usually in that order. To these factors we have to add another for the distance from the load center and therefore the transmission cost. It is impossible to work all these variables into one formula which would supply a quick answer to the question of which type of plant would be built next.

In a recent detailed study of the total cost per K.W.H. of power delivered to Edmonton from a coal-fired plant at Wabamun, forty miles away, or from a gas-fired plant located in Edmonton, it appeared that 8000 b.t.u. coal at Wabamun costing \$1.25 per ton was competitive with natural gas costing 15.57c at the Edmonton plant.

When investment is taken into account improvements in technology in gas or coal-fired plants are approaching the point of diminishing returns. It seems likely that any improvements will affect each type of steam plant equally. Gas turbine plants appear to have further possibilities for improvements in technology, but it is not likely that hydro plants will show a very great improvement.

In the above analysis we have not discussed nuclear plants. Such plants are being built in Great Britain, in the United States, and in Ontario. At the present time their total cost per K.W.H. generated is much higher than the cost per K.W.H. generated in modern gas or coal-fired steam plants using Alberta's low cost fuel. Undoubtedly very great improvements in technology will make great reductions in the total cost per K.W.H. generated in these nuclear plants, so that there does not seem to be any doubt but that some day that cost will be competitive with power produced from Alberta's low cost fuels. That day is not likely to be less than twenty years away but when it arrives it is probable that no further gas or coal-fired plants will be constructed. Plants of that type which are in existence at that time will probably continue to produce electricity from fossil fuels for many years after that, and it might be a further twenty years before they would all cease producing electricity.

7. NUCLEAR ENERGY

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NUCLEAR ENERGY

Summary

The conversion of nuclear energy to electrical energy has been done on a small scale. The engineering development needed before large-scale conversion can be accomplished is already under way. It will likely be 1970 before large nuclear reactors will be in operation industrially. During the 1960's the development will likely step from the pilot-plant stage (20,000 kw. electric) to the installation of a few plants, larger by a factor of 10.

The initial use of nuclear reactors will probably be the supplementation of existing water-power resources, particularly in regions lacking fossil fuels. It is considered that the well-established demand for liquid fuels will continue to increase into the foreseeable future with all modes of transportation making only negligible use of nuclear energy.

The primary production and the refinement of uranium both require large amounts of energy. The area around Lake Athabasca is an expanding source of uranium ore and hence a potential market for Alberta's natural gas. The world market for uranium will likely diminish briefly after 1962 but should experience a steady rise thereafter.

The over-all view is that the market for Alberta's liquid fuel resources will increase in the next 20 to 30 years, and that the impact of nuclear energy on this market will be negligible in this period.

The Present Stage of Nuclear Power Development

The first nuclear reactor was built in Chicago in 1942. Now, thirteen years later, there are more than forty reactors in operation throughout the world, about three-quarters of these being in the United States.¹ Although initially the objectives were solely military, this is not now the case. Broadly, the purposes of reactor projects fall into three categories.

- (a) The development of nuclear weapons.
- (b) The study of fundamental nuclear physics and the production of isotopes for peacetime uses, as for example, in medicine.
- (c) The study of the problems involved in the production of industrially significant nuclear energy.

These three categories are mutually dependent but only the third is of interest in this report.

Electrical energy was produced from a nuclear reactor for the first time on December 20, 1951, at Arco, Idaho.² The power generated at that time was 100 kilowatts, a trivial amount industrially. It served merely to demonstrate the physical possibility of changing nuclear energy to an industrially usable form. There remained, and still remain, major technological problems. The industrial use of nuclear energy awaits their solution. These problems may be outlined as follows:

- (a) A nuclear reactor operates with a high density of neutrons. Little is known about the behaviour of materials under prolonged neutron bombardment. Because of the intense radiation in a reactor, servicing can

¹ U.S. News and World Report: 31, Aug. 12, 1955.

² Nucleonics: 10, 2, 72, 1952.

be a major problem requiring total shut-down for many months. For a reactor to be industrially useful it must be reliable. It follows that the materials used in the construction of the reactor must be chosen to give trouble-free operation for periods of the order of 15 years.³ Materials-testing reactors have been in operation for several years, and progress is being made. Nevertheless a long-term program of such work is required before firm results will be obtained. A period of 10 or 15 years is a reasonable guess.

(b) The change of nuclear energy into heat energy is accomplished by using the heat generated in the nuclear reaction to operate a heat engine or a steam turbine, either of which in turn operates an electric generator in conventional fashion. A method of directly transforming nuclear energy into electrical energy is not known, and the prospects of discovering one are remote indeed. For thermodynamic reasons it is necessary to operate the reactor at high temperature, of the order of 1,000 degrees Fahrenheit, to obtain an efficiency of about 30%. Thus the reactor materials, as well as the heat-transfer fluids, must be capable of long-term operation at high temperature. Some work has been done on this problem, but more is needed.

A nuclear reactor for power production is to be built in Ontario and it is anticipated that it will be completed in 1958.⁴ It will operate at a power sufficient to produce 20,000 kilowatts of electrical power. This is an industrially small amount since the reactor is designed for test purposes.

The Probable Trend in the Development of Nuclear Power

The stored energy resources of the world are being used up at an increasing rate.⁵ ⁶ Because these are irreplaceable new energy sources are being sought. For this reason it is certain that nuclear energy will play a major role in the fairly near future. The known uranium and thorium reserves contain large amounts of energy. In the long-term view this will become important when reserves of fossil fuels have become depleted. Before this happens, however, nuclear energy will have become firmly established for another reason. The cost of the fuel is low, and the cost of transportation is negligible. This means that a nuclear reactor can operate in regions where fossil fuels and water-power are unavailable or do not meet the local energy needs. Ontario, for example, has negligible reserves of fossil fuels. It is expected that by 1960 the water-power resources of Southern Ontario will have been fully developed with the completion of the St. Lawrence Seaway. The increase in energy requirements beyond 1960 will therefore have to be met by some other means. It is hoped that nuclear reactors will meet this demand.⁴

Within the next 20 years the chief use of nuclear energy will likely be found in the supplementation of existing water-power resources, particularly in regions which lack fossil fuels. Because of problems already mentioned however, it is unlikely that this use of nuclear energy will have become significant much before 1970. On the other hand, once the engineering problems of large-scale nuclear energy have been solved, projects not previously attempted would become possible. For example, the distillation

³ Bull. of the Atomic Scientists: XI, 6, 224, 1955.

⁴ Bennet, W. J.: Can. Chem. Processing, 85, Feb. 1955.

⁵ Putnam, P. C.: "Energy in the Future", D. Van Nostrand, 1953.

⁶ Furnas, C. C.: Ind. and Eng. Chem. 46, 2446, 1954.

of sea-water into fresh water in significant amounts could be attempted. This could lead to irrigation and cultivation of present desert areas.⁶

The demand for liquid fuels has become firmly established over the past 50 years and this is a demand that cannot be met by nuclear energy. Much work has been done in the United States on the development of reactor engines for submarines, surface ships and aircraft.⁷ Apparently the submarine project has met with some success. The surface ship and aircraft projects are in their early stages and it is too soon to make firm comments. It is probable, though, that only the larger ships will be considered suitable for nuclear engines because of the massive shielding required for personnel safety. It is certain that only the largest aircraft, if any, will be run by nuclear engines, since in this case the shielding problem is even more serious. It is entirely unlikely that nuclear engines will be used in automobiles and locomotives in the foreseeable future. The twentieth century will probably continue to see liquid fuels used almost entirely for all modes of transportation.

The Probable Effect of Nuclear Energy on the Economy of Alberta

On the basis of the preceding analysis the conclusion is that the demand for the oil and natural gas of Alberta will be unaffected by nuclear energy for at least the next twenty years. Even in 1970, when it may be assumed that nuclear reactors will have become industrially significant, the demand for liquid fuels will continue.

The primary production of uranium has not yet been considered. The region around Lake Athabasca has become a major producer of uranium concentrates. Further extensive discoveries in this area are likely. Since the primary production of uranium ore requires substantial amounts of energy, there is here an increasing demand for Alberta energy reserves. If a refinery should be established, further large amounts of energy would be needed. The actual amount of uranium mined and processed will of course depend on the existing market. The present guaranteed Government market for uranium expires in 1962. After that time, if the military requirement is reduced, the market for uranium will be diminished for a few years. As more nuclear reactors are put into operation, however, the demand must again rise. During this period Canada's need for uranium will be greatly exceeded by our potential production. This means that export markets will have to be sought. Nevertheless it is conceivable that by 1975 the market for Canada's uranium will be as great as it is now.

Heavy water is used as a moderator in some nuclear reactors, and large amounts of energy are required for its production. Alberta, with its natural gas resources, is probably the best place in Canada for large-scale production of heavy water.

Some work has already been done to develop a method for controlled release of fusion energy.⁸ If such a method is ever discovered nuclear energy of the fusion variety is a vast new source of energy. The fusion reactions involve the use of lithium deuteride. Deuterium (heavy hydrogen) is obtained from heavy water, and lithium is found in significant quantities in the Yellowknife area. It is entirely likely that more work will be done on the controlled release of fusion energy within the next 20 years. If so, the eventual implications for Alberta could be significant.

⁷ Dean, Gordon: "Report on the Atom", Ch. VIII, Knopf, 1953.

⁸ Nucleonics: 13, 9, 10, 1955.

ALBERTA'S ECONOMIC PROSPECTS

MINERAL RESOURCES OTHER THAN FUEL

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ALBERTA'S ECONOMIC PROSPECTS

MINERAL RESOURCES OTHER THAN FUEL

With the exception of 10,000 square miles in the northeast corner of the Province, Alberta's geology is that of a sedimentary basin overlain by a thick mantle of glacial till. As a consequence, the mineral wealth of the Province is derived principally from the exploitation of non-metallics of glacial and sedimentary origin. The Pre-cambrian rocks exposed in the northeast corner have been too inadequately prospected to determine if they contain ore bodies of economic importance.

Next in importance to those minerals used in the production of energy is the group commonly called non-metallics, which are used in the construction industry. This group consists of sand, gravel, limestone, clay, shale and gypsum.

The minerals which are employed in the construction industry have been utilized during the entire period of development of the Province and a pattern of their use has been established which can be projected into the future. The minerals which will be subsequently discussed and which include silica sand, potash, phosphates and iron, are only on the verge of development, or are offered as only being possible of discovery or development. To attempt any quantitative projection of their utilization is not possible; however, their actual or possible presence will provide additional impetus to the overall industrialization of Alberta.

SAND AND GRAVEL

Sand and gravel of glacial origin have a wide distribution over the Province. There are localized depositions of sedimentary origin of which one is deposit of high silica sand suitable for industrial application and which will be discussed under a separate heading.

The principal uses of sand and gravel are in concrete manufacture and road building. In the latter case the local supply may be augmented by the use of crushed rock. Although the distribution is not sufficiently universal to prevent local shortages the quantity available in the Province is limited only by accessibility.

LIMESTONE, CLAY, SHALES, BENTONITE

Limestone occurs along the northeastern and western limits of the sedimentary basin covering most of Alberta.¹ The front range of the Rocky Mountains is composed of carbonate rocks, some of which are high calcium limestone. Those sections traversed by railways have had development since the early days of the Province. Some occurrences of marl have been observed in sediment basins west of Edmonton.

Clays and shales are distributed widely throughout the Province. They are usually of a low grade, being suitable only for the manufacture of common bricks, tile, cement and other similar products.²

Bentonite is a common constituent of Upper Cretaceous sediments in Alberta, the most promising deposits found to date occurring in the Bearpaw and Edmonton formations. All deposits tested to date, except for a thin bed occurring as a parting in a coal seam, were found deficient in

drilling fluid characteristics. Further prospecting especially in the Edmonton Formation may reveal bentonite of suitable quality for drilling fluids.³

There is at present one cement plant operating in the Province and one under construction. Two plants are producing lime and three sugar refineries produce their own lime. Nine firms are engaged in the manufacturing of either bricks or other clay products. Forty-one plants are producing cement products such as blocks, slabs and culverts.

GYPSUM

Two large deposits of gypsum occur within the Province. One of these deposits is on the border of Jasper National Park and the other is along the lower Peace River in Wood Buffalo National Park. Although both deposits have commercial possibilities, inaccessibility has prevented any efforts to exploit them.

SILICA SAND

Alberta has a large glass manufacturing plant at Medicine Hat for the production of bottles, jars and similar containers. The silica sand for this operation has been imported from Illinois. In recent years an extensive deposit of high grade silica sand was discovered at Peace River and is being developed.⁴ It will serve as the basis for a glass plant now under construction at Fort Saskatchewan for the manufacture of glass fibre, and filament, which will be processed into glass mats for oil and gas pipe line wrapping, a base for roofing materials, a reinforcing material for plastic structures and many other items. The development of this industry would keep pace with the rapid expansion in the laying of pipelines in Canada and in keeping with the growth of the construction industry. The next two or three decades will see an increase in the use of glass reinforced plastics as a structural material in such objects as boats, automobile bodies and helicopter bodies. The Peace River silica sand deposit could also serve to supply the Medicine Hat glass plant and the ceramic industries in that area.

The sand in the Athabasca Oil Sands is also suitable for glass manufacture and the recovery of oil from the oil sands would release tremendous quantities of silica sand as an industrial raw material.⁵

COMMON SALT

A large section of East Central Alberta is underlain with common salt. The area in which salt may be encountered is approximately 400 miles long by 125 miles wide and extending from McMurray on the north to Princess on the south, and from just east of Edmonton to the Saskatchewan border.⁶ The thickness of the bed varies up to 1,000 feet.

Continuous production of salt in Alberta commenced in 1938, and after increasing rapidly in the early stages stabilized at about 30,000 tons annually over the past 10 or 12 years. Salt is used for domestic purposes in the meat and fish-packing industry, de-icing streets and a variety of other uses. As a stock food it may be used as a vehicle to supply livestock with deficient minerals such as iodine and cobalt. The use of salt in Alberta is increasing at a greater rate than is suggested by the approximately constant production over the past decade. The difference is made up by the establishment and operation of a salt plant at Unity, Saskatchewan across the border from Alberta, in place of that company's plant at Waterways, Alberta. It is expected that the production of salt for its use as com-

mon salt will increase at a rate in keeping with general growth of this province.

Two years ago a plant was built for the production of caustic soda and chlorine. While public figures on production are not available, the production of the plant has increased steadily and expansion is planned. The recent rapid development of chemical industry in Alberta has created a substantial demand for both caustic soda and chlorine, to the point where a plant of economic size could be established. This plant made available these products which will lead to the development of further industries utilizing these chemicals. Chlorine is available for use in the pulp and paper industry being established at the present time, and for the chlorination of any abundant hydro-carbons. Sodium hydroxide, a most important base too will be available in the development of chemical industry. The rate of growth of caustic soda-chlorine production can be expected to keep pace with the expected rapid development of the petrochemical industry as outlined in the section on the growth of the petrochemical industry.

POTASH

Extensive deposits of potash have been discovered and are being developed in Saskatchewan. In the drilling for oil through salt beds in Alberta only minor amounts of potash were encountered. The potash could have been removed by solution after deposition, or the centre of the basin may have been shifted while the potash was still in a solution state.⁴ The latter explanation has interesting possibilities for, if true, the main body of potash still awaits discovery.

PHOSPHATES

Phosphate deposits are mined extensively in the States of Idaho, Montana and Wyoming. The same formations extend northward into the Canadian Rockies and phosphate beds have been observed as far north as the Athabasca River.⁷ Investigations to date have not revealed deposits of sufficient thickness and phosphoric acid content to be considered of economic value. However, there is always the possibility that further prospecting in this favourable area may uncover deposits of economic value. This is true since phosphate is sometimes very difficult to recognize in the field.

Potash and phosphates are used as fertilizer and any commercially important discoveries of them would contribute substantially to the growth of the fertilizer industry in Alberta. This province is already making rapid strides in the development of nitrogenous fertilizers. An ammonium nitrate plant has been producing at Calgary for twelve years. Last year production of ammonium sulphate commenced at Fort Saskatchewan. Another ammonia fertilizer plant is being constructed at Medicine Hat and this plant will also produce ammonium phosphate, utilizing imported phosphate rock. The development of any potash and phosphate resources in Alberta would enable production of all three major nutrients required in soil fertilization.

SULPHUR

The reserves of sulphur in Alberta are contained within the oil and natural gas and oil sands of the province, and consequently the rate of production of this resource will be determined not by its own economic forms, but by economics governing oil and gas production. For this reason, sulphur will be given treatment in that section of the report dealing with the growth of the petrochemical industry.

IRON ORE

There are several known occurrences of iron in Alberta. However, only two are considered to be of sufficient significance to warrant mention in this report.

Near the Town of Burmis in the Crowsnest Pass three iron-bearing beds, consisting of black magnetic sands occur interbanded in sandstones.⁸ These beds have been traced over a distance of eight miles and have been observed up to thicknesses of eight feet. Examination of the out-crops indicates an average iron content of forty per cent and also a titanium oxide content of about five per cent. The titanium in the ore presents a metallurgical problem and this increases the cost of the recovery of iron from such ores. In recent years a private company has undertaken a core drilling program of the area, but there is no public information on the results.

In 1953 a crew drilling for oil or natural gas in the Clear Hills in the Peace River country encountered an iron deposit in four base holes. Subsequently, an interested company undertook to core drill the region and reported that they had outlined a deposit thirteen miles long by 3.3 miles wide and averaging ten feet thick.⁹ This would indicate an iron ore reserve of a billion tons. The overburden varied from nil at the out-crops up to 200 feet. The ore appears to be mainly siderite (iron carbonate) containing about 48 per cent Fe_2O_3 . This is not a high grade deposit though ores of a similar iron content are worked elsewhere in the world where economic conditions are more favourable.

At the present time the value of the products of iron and steel are running at about four per cent of the total value of manufactures in the province.¹⁰ This industry consists of machine shops, foundries, bridge and structural steel, sheet metal products, farm implements, tanks and the like. The iron and steel industry is entering a new phase in the province with the present construction at Edmonton of a steel mill for the production of reinforcing steel and a variety of rolled products and also a pipe mill. The steel mill will operate on scrap, but the establishment and expansion of the industry will encourage and enhance the day when Alberta's iron ore resources will be developed.

In addition to the natural iron resources, there are as by-products of industry at Fort Saskatchewan and Kimberley, B.C. tailings containing iron in sufficient quantity to be a useful source of the metal. Considerable research will be required before either the natural deposits or the tailings can be readily reduced to iron to serve a steel industry, but as the development and industrialization of Western Canada proceeds, these iron reserves will, no doubt, be worked for the benefit of the iron and steel industry in this area.

SODIUM SULPHATE

Some deposits of sodium sulphate are known in the lakes in the eastern part of Alberta, but they are quite small and are not considered of economic importance. The establishment of a pulp and paper industry would make this mineral of interest in Alberta. However, it appears that the requirements will be met from the established sodium sulphate industry in Saskatchewan, based on its abundant resources of that mineral.

PROJECTION OF THE VALUE OF NON-METALLIC MINERALS USED IN THE CONSTRUCTION INDUSTRY

The attached chart shows the value of non-metallic minerals exclusive of fuels in Alberta for the period 1941 to 1953. The following factors are considered to have influenced the shape and direction of the curve to 1953.

1. At the end of the war there was a critical shortage of manufactured construction materials, particularly iron and steel products. This situation was aggravated by lack of purchasing power, restrictions on foreign exchange and government controls. This curtailed construction to a marked degree.

2. Oil development after 1947 produced a heavy demand for cement, causing a shortage of domestic supply for construction.

3. The effect of increased availability of manufactured construction material and the buoyant effect of additional revenue in the provincial treasury subsequent to 1950 has led to the institution of a large public works program which has resulted in a rapid annual increase in the value of non-metallics since 1951.

4. The value of non-metallics as a proportion of the total value of manufactured products in Alberta rose to 4% in 1948 and has stabilized at that level indicating that the rate of growth of this industry is proportional to the total rate of growth of the manufacturing industry.¹¹

In attempting to forecast the future growth of the industry the following conditions and assumptions are postulated:

1. There is an abundance of the non-metallics concerned and supply will be able to meet demand in the projected future. In addition, there is the possibility that new deposits of these minerals and of minerals not now in use will be made.

2. The abundance of these minerals will ensure a relatively stable cost which will encourage their substitution of other construction materials where possible.

3. The increase in population will provide an impetus to the construction industry through housing and an increase in industrial development.

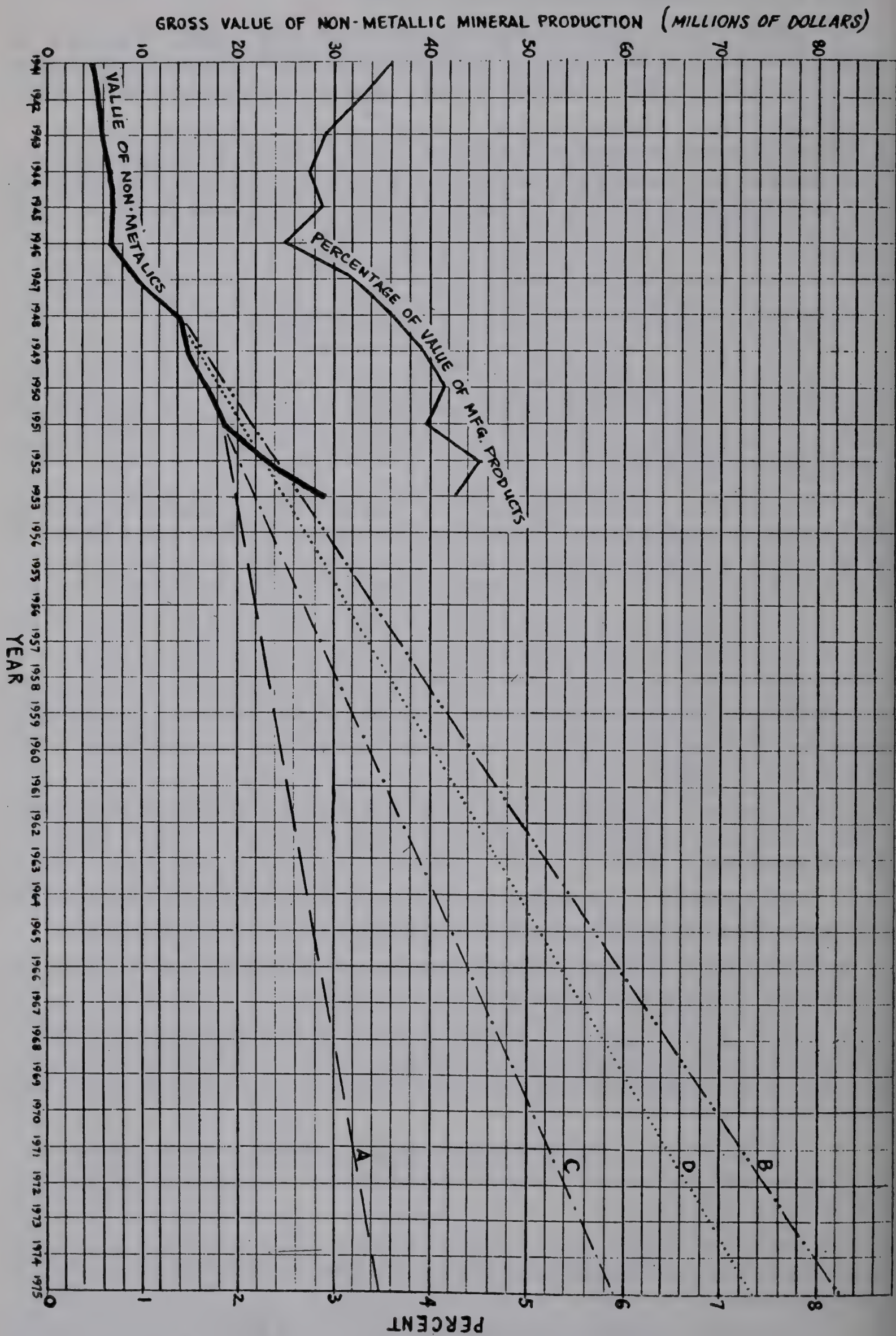
4. The present level of oil and natural gas exploration and development is expected to continue for the next twenty years.

5. There is no reason to believe that there will be any reduction in public works construction. On the contrary, a recession in the construction industry would probably be compensated for by increased public works expenditures.

6. A steady increase in the industrial development of the agricultural, oil and natural gas, forestry, chemical and other industries of the province can be anticipated.

7. The non-metallics are a bulky, low-cost product consumed principally in this area and are consequently an indication of the rate of growth of the province.

The chart on page 11 shows several curves of past and projected production of non-metallic minerals in terms of gross value.

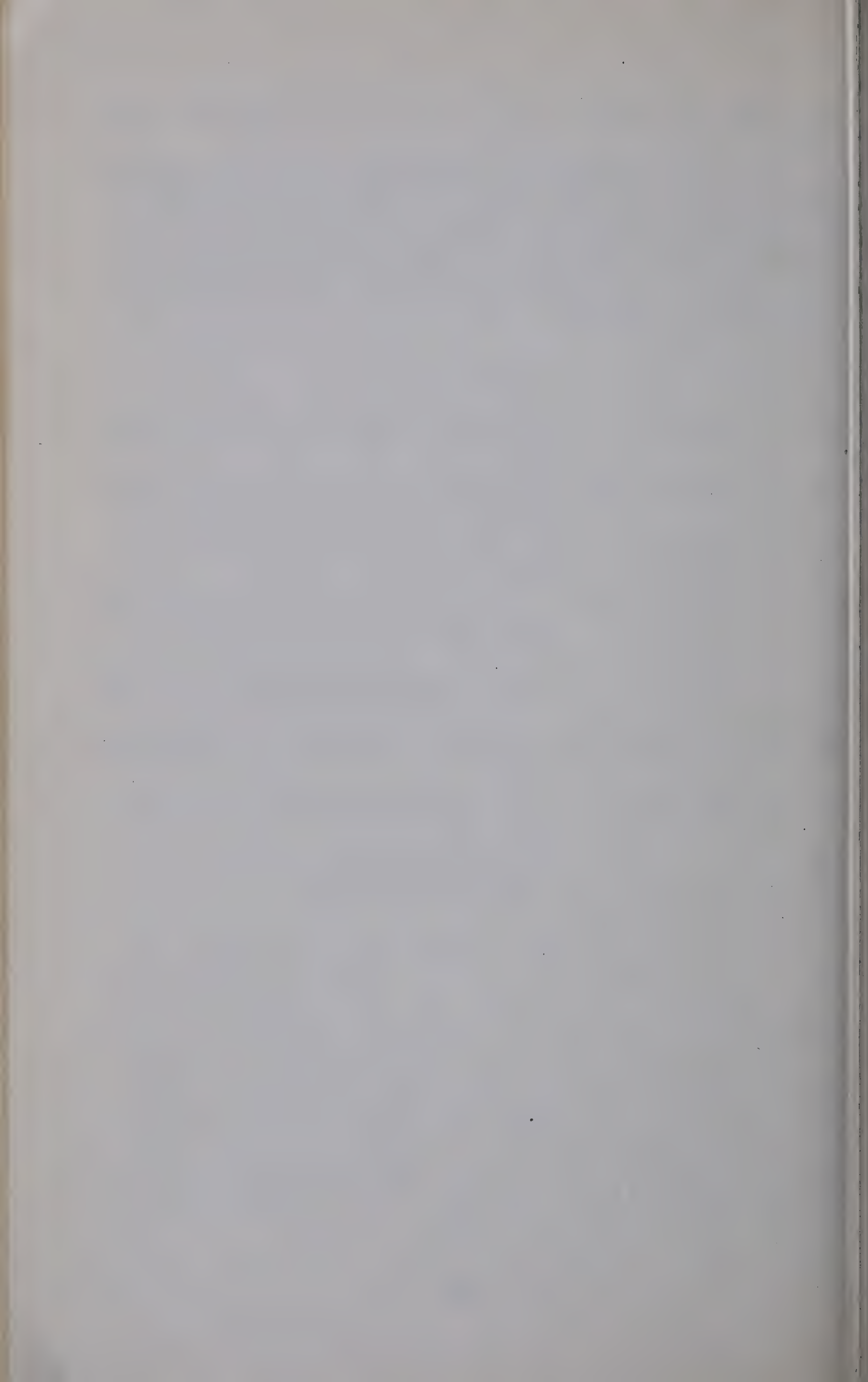


Curve "A" indicates a rate of growth based on population growth from 1951 to 1975.

Curve "B" is a projection of the rate of growth of the industry from 1948 to 1952. The rapid rate of post-war development and industrialization and the quantities of cement materials used in oil exploration and development have exaggerated the rate of growth of non-metallics. A more realistic estimate of future production is somewhere between these two curves. Curve "C" is midway between the two. This is probably a bit conservative in the light of the contributing factors and Curve "D" is considered to be a more accurate projection.

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ALBERTA'S ECONOMIC PROSPECTS

FORESTRY

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Royal Commission On Canada's Economic Prospects

FORESTRY

Abstract

With the assistance of aerial surveys the forest inventory of the Province will be completed by March 31, 1956. That portion below the 57th parallel was completed in 1953 and from a study of the inventory we are now in a position to determine the amount of timber that may be cut on a sustained yield basis. While spruce provides 85% of our forest production, an examination of the more accessible areas covered by the inventory indicates that the future cutting of spruce will have to be studied to ensure a supply for the future.

The Province has large resources of pine timber that are not now being utilized because of the lack of markets for pine products. It is hoped that markets will be found to allow a continuation of our overall timber production and to take care of an expected increase in the future.

The inventory indicates that poplar makes up 45% of our timber stands. These stands are now coming into production with the construction of plywood plants. It is anticipated that this production will increase.

Increased expenditures on forest protection during the past few years will help to ensure the supply of timber for available markets.

The establishment of a long term land-use policy is desirable.

In considering the economic prospects of the forest industry in Alberta, the Province is in the fortunate position of having as nearly accurate information of its forest resources, as it is presently possible to obtain. It is also, the only province that has completely photographed its entire area from the air. The aerial survey conducted over the past several years has provided a forest inventory that depicts the situation today, and at the same time points the way, and the policy, the province will probably follow to maintain the forest as a continuing resource of wealth in the years to come. Unfortunately, at this date, not all the information pertaining to forestry has been analysed for much of the northern area and other isolated spots. Because of this, it is difficult to predict, or draw conclusions, with any degree of certainty from the part already analysed, and apply it to the province as a whole, without considerable reservations. However, for the areas south of the 57th parallel, presently accessible and under timber operations, a very comprehensive picture has been obtained of the forest situation in this area.

Before going further, let us see in a simple way how this picture has been obtained from the aerial photographs by considering a very small area. From the photographs of this small area, experienced foresters have distinguished the various species of trees, their height and probable volume, and broad maturity classes. They also have distinguished the burned and cut-over areas. Thus, the foresters have determined how many acres are forested, and with what species and volume, the number of acres burned and cut-over, the number of acres in lakes, rivers and swamp land, etc. Spot checks have been made on the ground for verification, particularly as to volume. Eventually, figures have been derived for the area, in thousands of feet board measure. At the time of writing 81,407 square miles have been so inventoried. It is hoped that the remainder will be completed by March 1956, at which time 142,186 square miles will then be inventoried plus an additional 8,619 square miles included in the East Slope.

However, notwithstanding the fact that the inventory is incomplete, the picture that the 81,407 square miles presents, should be given serious consideration in determining the economic prospects of the forest industry.

By referring to Table I and Graph I, it can be readily seen that the production of all forest products has risen fairly steadily from 73 million feet board measure in 1930-31, when the resources were transferred to the province, to the 400 and 500 million mark in recent and post-war years. Until the advent of the present inventory no one could tell whether or not a cut of 73 or 500 million feet was reasonable or excessive. With the figures that are now being developed, this will no longer be the case. Annual depletions through harvesting, fire, disease and insects can be subtracted from known stands, and regulatory measurements can be undertaken as found necessary. It is roughly estimated that about 85% of production is probably spruce and the other 15% pine, the two most common species used commercially in Alberta.

From data accumulated to date it would appear that because of heavy cutting and fire, white spruce will probably have to be placed on a sustained yield basis in those areas where timber operations have been carried on in the past. What measures to be taken, and in which areas, will depend on the picture presented on completion of the inventory.

With the establishment of one pulp mill, and the possibility of others, it is imperative that planning for the future be given careful consideration. In this, the Forestry Branch has made a commendable start. With the information presently at hand, the province (south of the 57th parallel) has been mapped as to management areas, (see map) and the conditions in each of the accessible areas have been analysed, insofar as white spruce and pine are concerned, and the possible corrective measures to be taken to place these areas on a sustained yield basis. In some areas it may mean the selling of only decadent timber, in others, the selling of only mature and decadent spruce, or possibly complete restriction.

It will mean the opening up of other areas reasonably accessible and areas hitherto considered inaccessible through lack of roads or economically unfeasible, because of distance and other factors. It is also possible, that if operations are pushed farther back and more selective cutting employed, the cost to the operators will go up unless they can devise some cheaper system of extraction.

In the light of the figures now being developed by the forest inventory, the administration of Alberta's forests is in a transitional stage at this time. Consequently, any discussion to follow will have to be confined to the forested area to the south of the 57th parallel, the area for which information is available. No study has yet been made of the area between the 57th and the 60th parallel, which is the northern limit of the province. Figures have been calculated on an accessible and inaccessible basis, which may be defined for the Northern Alberta Forest and the East Slope as follows:

Northern Alberta Forest (N.A.F.)

Accessible—All those management units south of the 57th parallel of latitude in which timber operations existed or timber applications had been made prior to January 31st, 1955. This includes the North West Pulp and Power lease area.

Inaccessible—All those management units south of the 57th parallel of latitude

in which no timber operations existed or timber applications had been made prior to January 31st, 1955.

Eastern Rockies Forest Conservation Area (Commonly known as the East Slope)

Accessible—All areas under 6,000 feet in elevation.

Inaccessible—All areas over 6,000 feet in elevation.

No discussion of forestry can overlook the question of fire. A glance at Table II shows that the fire loss since 1930 has ranged from a low of 6,320 acres in 1935 to a high of 1,758,346 acres in 1938, with fires close to one and a half million acres each in 1941 and 1949. The variations from year to year are well illustrated in Graph 2, weather, of course, being the largest single factor accounting for these great variations and such variations mean that a fire-fighting force and system has to be planned, built-up and maintained at a level to contend with the maximum emergencies. That this protection is rapidly developing is indicated by the fact that in 1940 there were 8 lookout stations, where there are now 41. With another 11 lookout stations now under construction, the figure will be raised to 52 by the end of the fiscal year. Radio is now used, where formerly there was none. At that date, fires in the more inaccessible areas burned freely, while today, fires are being fought in every corner of the province. Expenditures on equipment and personnel are now ten times greater in order to provide a safer measure of protection.

In planning for the future it is desirable that some idea be obtained as to the area that will remain in more or less permanent forest, the types of land included in a permanent forest, the areas that are presently forested, and the areas potentially productive or non-productive. Table III gives this breakdown for 70,071 square miles, considered to be the area that will remain in permanent forest south of the 57th parallel. Of this area, 61,452 square miles are in the N.A.F. and 8,619 miles in the East Slope. Seventy-one per cent of the N.A.F. is considered productive or potentially productive land, and 64.7 per cent productive in the East Slope.

Tables IV and V give the cover types for these two areas, and the volumes for the various species shown. When consulting these tables, it should be remembered that for the N.A.F. the picture is not yet complete, for there are over 60,000 square miles north of the 57th parallel still to be analysed. By and large the more northern timber is not usually as good as that found farther to the south. However, from these tables it would appear that measures may have to be taken to put white spruce on a sustaining basis, once the mature and over mature timber is removed. On the other hand, there are considerable quantities of pine that is not being cut. If some of the production of white spruce could be switched to pine to ease the cutting pressure on white spruce, total production could be kept at a high level, while white spruce is being placed on a sustained yield basis. There seems no question that pine is equally as good, and in some instances slightly better, than spruce as to appearance, strength and workability. It would appear that lack of large quantities of sawlog-size pine is one of the factors why this species has not been cut to a greater extent, also to the fact that the consumer is not aware that pine is equally as good as white spruce. By referring to Table IV, it will be seen that in the accessible area under mature coniferous, there is a figure of nearly 2,114 million feet of white spruce 12" diameter and over at breast height, while the figure for pine is less than 1,320 million. On the other hand, there is over 4,078 million feet board measure of pine between 4 and 10 inches, and less than 1,987 million for spruce between 4" and 11", which is a little larger size group-

ing. This is one of the reasons why white spruce has been cut more extensively than pine. Another possible reason would be, that because of the large quantities of spruce on the markets in the past, the trade is more likely to ask for spruce than pine. There is a further reason, and from the export angle, it is more difficult to export pine to the United States on account of their pine regulations. Therefore, it is natural for timber operators to cut a product that can be processed at a lower cost and with a wider sales range. It would thus appear that promotion of pine as an alternative to white spruce is imminent, and necessary, if Alberta forests are to be kept on a high productive level on a sustaining basis. Otherwise, the white spruce saw log operators will eventually find that their cuts are reduced, because they have not built up a pine market during the time it will be necessary to rebuild the white spruce stands.

With the advent of the new pulp mill swinging into operation, probably in the 1956-57 season, production will be increased another 135 million board feet to some point probably beyond the 600 million mark. Another mill of the same size, which is not unlikely, would increase production well beyond the 700 million mark. Unless some provision is made within a pulpwood area for sawlog material, it is reasonable to assume that the pulp mills would manage their areas to obtain the maximum yield of pulpwood, which would preclude trees ever reaching the sawlog size.

With the establishment of two new plywood mills, in addition to the one at Grande Prairie, production will eventually be raised another 20 to 30 million. Fortunately, they will be using poplar, of which there is an abundance. In the areas studied to date, 45% of the forest growth is poplar, which would suggest that markets should be developed for its utilization. It is easy to grow and reaches maturity in about 80 years. Also, there is a definite and large demand for poplar plywood, particularly in the eastern parts of the continent. In certain cases, as in construction, poplar plywood is preferred to Douglas fir plywood.

Let us now turn to the question of how Alberta forest products are used. In this we are handicapped by the lack of suitable and adequate data, but these are sufficient to be indicative, although they do not show the breakdown by species. And further, the information is based only on operators reporting to the Dominion Bureau of Statistics, and consequently, there is a decided discrepancy between provincial and dominion figures. Table VI shows the shipments of sawn lumber to the various provinces, the United States, United Kingdom and other countries, also shipments from other provinces to Alberta. The information is illustrated graphically through graphs 3 to 8, which have not been extended to future years in the light of what has been written previously. Graph 3 shows that shipments to points in Alberta have remained more or less constant with a slight uptrend in recent years. Similarly, shipments to other provinces have remained more or less constant, while shipments to the United States have increased considerably. This is better illustrated in Graph 4. A glance at Graph 5 shows, that although production is increasing, percentagewise, shipments to points in Alberta are decreasing, shipments to the United States are increasing, with shipments to other provinces showing little variation. Graph 6 shows that although exports from the province are increasing, imports from other provinces are taking its place in Alberta consumption. Also that shipments from British Columbia constitute the largest single factor in Alberta importations, as shown by Graph 7. In an attempt to arrive at the probable consumption of forest products in Alberta, the figures for shipments to points in Alberta were taken, to which were added the importations, plus

the discrepancy between total shipments, and production, which it was assumed were used locally. These were plotted in graph 8, but in view of the fact that the information was drawn from the returns of reporting operators only, the total annual consumption for each year is probably one-third to one-half greater than is shown in the graph.

One of the reasons the curves were not extended in these latter graphs, hinges on the fact that the direction of the extended curves is entirely dependent on what measures are taken to place white spruce on a sustaining basis, and white spruce is the crux of the situation, whether or not fire losses can be reduced to an acceptable minimum, and whether or not pine can be promoted and accepted on the market in place of spruce. It will mean teamwork on the part of an informed public, wise and intelligent use by operators and government, and close cooperation with other agencies competing for land use, such as agriculture.

With the population and construction curves on the uptrend, it is conceivable, that on the one hand, if no further action is taken, production will increase, shipments to the United States will increase, with British Columbia picking up the slack, until a point is reached, where production starts to dwindle, shipments to the United States fall off, and British Columbia fills the void with saw lumber. Time does not permit to calculate when this point might be reached, but a perusal of the figures in Tables IV and V for white spruce over 12" in diameter in the overmature and mature brackets for both accessible and inaccessible areas, and depending on how quickly the immature moves over into the mature bracket, a rough guess might place the point within the 15 to 30 year range, possibly longer, and maybe a shorter length of time. On the other hand, with the present action being taken by the Forestry branch to increase the fire protection facilities, one would expect, that because of present commitments, production will go up for the next 10 years, shipments to the United States will go up, as will the shipments from British Columbia. If, during this 10-year period, the trade can be educated to use pine, between 350 to 500 million feet of pine, depending on the rate of burn, could go into production on a sustaining basis. Costs of production, undoubtedly, would be higher, for the smaller-sized pine, and for cutting in the more inaccessible areas, but it might not be appreciably so. This factor would tend to lower the upward trend of the production curves. On the other hand, oil exploration has opened roads into many of the inaccessible areas, and logging is now taking place in these areas. If pine can bridge the gap of time it will take to bring immature white spruce to maturity or sawlog size, the vanishing point of sawlog material, mentioned earlier, need never be reached; if it can not, and measures are taken to put white spruce on a sustaining basis, then the production curve will rise for the next 10 or 15 years, then fall off, and continue to fall, then gradually rise again to the presently calculated annual sustained yield under a reduced rate of burn. If pine is acceptable, then another 500 million feet could be added, which would mean that Alberta forests could produce over 800 million feet annually on a sustaining basis, if conditions warrant such a production in the future. The decision as to which path the Alberta forest industry is to follow is a momentous one, and one that requires careful thought and consideration.

However, the situation is broader in scope than the forest industry. More is at stake than the retention of a phase of forestry, for it involves the wise and intelligent use of land, and all the agencies competing for the use of it. Forests have to be managed on a permanent basis, for it is useless to spend time and money on lands which are later to be opened

for settlement, only to find that it would have been better to have left it as forested land. The protective influences of the forest include the stabilization of the soil, the promotion of clean and well distributed stream flow,

recharge of ground waters, and the reduction of damaging winds and floods to crop lands, homes and settlement. Thus, some long-term broadly-conceived program is indicated, in which basic principles of land use are applied to properly develop surface resources in which forest and agricultural land is kept in balance for the optimum benefit of both. These include the effects of the removal of the forest cover on climate, both regional and local, on surface and sub-surface drainage, and the recharge of groundwater levels, or erosion control, on wind movement, on wildlife, and on the interrelations of each and all of these on the economic interests involved, and on the overall effects on society. Some of the objectives would be as follows:—

1. Prevention of unwise, wholesale land clearing for quantitative agricultural settlement.
2. Provision for grouping of settlement with a view of economizing public expenditure, for roads, schools and other social services.
3. Provision for permanent farming communities.
4. Provision for permanent forest communities.
5. Provision for future land settlement expansion.
6. Prevention of wastage of water resources, floods and serious erosions.
7. Provision for future timber supplies.
8. Provision for recreational areas.
9. Provision for complementary aspects of resource development. Farming for wood products as well as for agricultural produce.
10. Revaluation of former forest lands in the province presently in the settlement zone.

TABLE I
ALBERTA'S FOREST PRODUCTION FOR THE YEARS 1930-31 to 1954-55 INCLUSIVE

Fiscal Year	Total Lumber	Pieces	Total Ties	Other Products	Total Production	No. L.T.B.'s and S.T.P.'s*	Av. Vol. per L.T.B. and S.T.P.*
	F.B.M.		F.B.M.	F.B.M.	F.B.M.		F.B.M.
1930-31	40,582,155	667,606	23,366,210	9,187,340	73,135,705	—	—
1931-32	51,376,498	231,715	8,110,025	13,832,226	73,318,749	—	—
1932-33	55,484,814	266,748	9,336,180	16,400,198	81,221,192	156	447
1933-34	62,840,093	650,790	22,777,650	12,324,405	97,942,148	158	530
1934-35	71,897,832	1,143,426	40,019,910	12,424,876	124,342,618	190	566
1935-36	90,052,681	1,422,197	49,776,895	40,367,691	180,197,267	254	611
1936-37	104,492,418	1,206,237	42,218,295	16,213,563	162,924,276	316	443
1937-38	146,301,510	1,030,700	36,074,500	35,738,440	218,114,450	295	634
1938-39	122,450,579	1,185,819	41,503,665	15,810,064	179,764,308	287	544
1939-40	131,497,021	829,846	29,044,610	14,209,160	174,750,791	339	442
1940-41	185,752,504	1,375,024	48,125,840	11,395,031	245,273,375	291	722
1941-42	272,345,129	1,086,823	38,083,805	14,608,638	324,992,572	335	818
1942-43	228,703,425	1,797,703	62,919,605	19,734,919	311,357,949	361	706
1943-44	182,407,992	1,286,684	45,033,940	23,348,663	250,790,595	425	508
1944-45	353,625,868	3,056,257	106,968,995	34,797,253	495,392,116	647	657
1945-46	273,259,563	2,284,650	79,962,750	32,715,921	385,938,234	666	497
1946-47	352,348,345	1,671,473	58,501,555	43,520,861	454,370,761	695	588
1947-48	390,997,404	1,497,883	52,425,905	58,488,848	501,912,157	556	812
1948-49	366,351,842	1,659,742	58,090,970	38,055,972	462,498,784	1,090	382
1949-50	297,821,740	853,587	29,875,545	18,844,022	346,541,307	988	319
1950-51	419,364,344	1,126,708	39,434,780	42,106,756	500,905,880	970	485
1951-52	369,010,091	1,404,861	49,170,135	69,484,742	487,664,968	1,314	353
1952-53	398,389,389	1,587,979	55,579,265	26,782,899	480,751,553	1,276	358
1953-54	373,545,332	1,289,129	45,119,515	22,379,657	441,044,504	941	446
1954-55	412,012,369	753,462	26,371,170	20,019,287	458,402,826	—	—

* Average volume production of all products on Licensed Timber Berths and Special Timber Permits or their equivalent for Provincial and Forest Reserve Lands. Settler Permits have been omitted because they only account for approximately 10% of the total production even though they are several times greater in number than Licensed Timber Berths and Special Timber Permits.

TABLE II

**ALBERTA FIRE LOSSES AS TO SIZE, VALUE AND COST OF SUPPRESSION FOR
THE PERIOD 1930-53, INCLUSIVE**

Year	Fires	Area	Total Loss	Av. Loss Per Fire	Total Supp.* Cost	Av. Supp.* Cost/Fire
	No.	Acres	\$	\$	\$	\$
1930	56	11,187	80,023	1,429	1,238	22
1931	622	604,876	867,487	1,395	99,713	160
1932	379	136,118	160,876	424	18,812	50
1933	288	93,765	195,805	680	35,382	123
1934	240	58,870	126,022	525	38,169	159
1935	97	6,320	5,768	59	1,653	17
1936	248	204,454	1,549,930	6,250	122,542	494
1937	375	835,259	1,088,466	2,903	55,340	148
1938	521	1,758,346	2,046,236	3,928	217,055	417
1939	499	429,139	642,110	1,287	148,298	297
1940	313	474,244	954,031	3,048	67,231	215
1941	445	1,355,425	2,050,979	4,609	170,488	383
1942	215	325,816	356,934	1,660	40,546	189
1943	265	515,149	197,157	744	22,287	84
1944	325	722,658	1,698,883	5,227	88,086	271
1945	284	216,736	261,782	922	64,002	225
1946	275	272,283	121,293	441	54,129	197
1947	122	80,060	37,344	306	18,539	152
1948	184	293,217	241,977	1,315	90,904	494
1949	314	1,461,047	4,269,291	13,569	248,636	792
1950	248	705,687	2,334,966	9,415	336,304	1,356
1951	84	23,868	81,403	969	25,092	299
1952	192	484,329	1,286,538	6,701	70,443	367
1953	140	334,101	1,928,037	13,772	188,202	1,344

*Suppression

TABLE III

FOREST RESOURCES OF ALBERTA AS TO KINDS OF FORESTED LAND AND AREA THAT MAY REMAIN AS PERMANENT FOREST SOUTH OF THE 57th PARALLEL

A. Northern Alberta Forest Districts

	Accessible		Inaccessible		Total Accessible & Inaccessible		% of Total
	Acres	Acres	Acres	Acres	Acres	Acres	
Presently forested land: -----							
Potentially productive land: -----							
Brushland -----	3,163,363	15,062,057	2,258,155	4,024,669	5,421,518	19,086,726	48.5
Recent burn -----	1,964,839		1,431,316		3,396,155		13.8
Clear-cut -----	28,213				28,213		8.6
Blow-down -----	544				544		0.1
TOTAL -----		5,156,959		3,689,471		8,846,430	22.5
Non-productive land: -----							
Water -----	504,926		588,541		1,093,467		2.8
Cleared or cultivated -----	118,829				118,829		0.3
Muskeg -----	4,569,553		4,781,756		9,351,309		23.8
Grassland -----	5,150				5,150		
Hay meadow -----	459		3,561		4,020		
Above Treeline -----	177,170		558,996		736,166		1.9
Stunted due to elevation -----	24,321		62,887		87,208		0.2
TOTAL -----		5,400,408		5,995,741		11,396,149	29.0
GRAND TOTALS -----		25,619,424		13,709,881		39,329,305	100%

B. Eastern Rockies Forest Reserve

	Accessible		Inaccessible		Total Accessible & Inaccessible		% of Total
	Acres	Acres	Acres	Acres	Acres	Acres	
Productive merchantable -----							
Productive young growth -----							
TOTAL -----	940,736		216,192		1,156,928		21.0
Non-productive -----	2,034,112		377,536		2,411,648		43.7
TOTAL -----		2,974,848		593,728		3,568,576	64.7
Non-productive -----		1,052,032		895,552		1,947,584	35.3
GRAND TOTAL -----		4,026,880		1,489,280		5,516,160	100%

TABLE IV

FOREST RESOURCES OF ALBERTA AS TO COVER TYPES, AGE, AREA AND VOLUME IN THOUSANDS OF FEET BOARD MEASURE FOR WHITE AND BLACK SPRUCE, BALSAM FIR, PINE AND DECIDUOUS SPECIES IN THE NORTHERN ALBERTA FOREST SOUTH OF THE 57th PARALLEL.

Accessible

Cover Type*	Maturity Class	Area Acres	Area as % of Total	Sw 4'-11" DBH	Sw12"+ DBH	Sb	Fb	P4"-10" DBH	P11+ DBH	Deciduous
			%	MFBM	MFBM	MFBM	MFBM	MFBM	MFBM	MFBM
Coniferous	Regeneration	210,402	1.4							
"	Young	2,465,314	16.4	2,707,289	214,578	475,587	312,089	8,726,092	1,124,824	581,981
"	Immature	3,127,975	20.8	4,564,144	1,898,401	1,862,099	1,809,365	14,489,636	2,652,010	1,219,038
"	Mature	1,001,566	6.6	1,986,727	2,113,691	402,431	1,113,721	4,078,340	1,319,584	713,421
"	Overmature	154,981	1.0	568,029	1,149,380	21,715	178,580	168,808	150,499	256,158
Conif-Decid.	Regeneration	62,772	0.4							
"	Young	734,866	4.9	898,299	225,079	91,925	50,037	1,274,015	596,799	1,751,072
"	Immature	1,171,963	7.8	3,369,924	2,323,686	345,223	217,203	1,820,844	1,344,149	5,273,042
"	Mature	275,463	1.8	767,822	962,144	124,517	97,442	402,604	261,987	1,547,017
"	Overmature	52,508	0.3	173,934	308,737	3,655	16,822	29,487	44,528	329,028
Deciduous	Regeneration	462,324	3.1							
"	Young	1,765,360	11.7	343,545	56,793			23,221	56,172	11,390,605
"	Immature	996,094	6.6	484,247	288,534		459	112,926	61,841	12,146,981
"	Mature	72,460	0.5	35,789	14,174	967	1,880	11,521	1,999	831,496
"	Overmature	13,607	0.1	5,378	5,177	7	364			191,166
Decid-Conif.	Regeneration	68,355	0.5							
"	Young	892,354	5.9	841,371	301,978	186,048	38,686	427,729	290,741	3,417,622
"	Immature	1,341,007	8.9	2,973,660	1,691,372	177,656	176,456	755,737	737,693	10,702,273
"	Mature	171,475	1.1	419,294	342,162	11,710	29,327	67,412	62,237	1,576,859
"	Overmature	21,211	0.2	53,538	51,498	1,393	4,189	1,441	3,756	197,868
TOTALS		15,062,057	100.0%	20,193,170	11,947,384	3,704,933	4,046,620	32,389,813	8,708,819	52,125,627
Volume %				15.2%	9.0%	2.8%	3.0%	24.3%	6.5%	39.2%

Total Volume all species = 133,116,366 thousands of board feet.

TABLE IV—(Continued)

Inaccessible										
Cover Type*	Maturity Class	Area	Area as % of Total	Sw 4''-11'' DBH	Sw12''+ DBH	Sb	Fb	P4'' - 10'' DBH	P11+ DBH	Deciduous
		Acres	%	MFBM	MFBM	MFBM	MFBM	MFBM	MFBM	MFBM
Coniferous	Regeneration	88,702	2.2							
"	Young	488,736	12.1	150,170	11,020	191,573	17,545	883,000	92,898	43,153
"	Immature	523,316	13.0	987,965	434,687	595,844	354,478	904,761	235,494	188,431
"	Mature	88,178	2.2	160,491	120,262	36,335	65,073	269,459	78,325	50,958
"	Overmature	4,968	0.1	13,241	30,964	1,188	4,933	4,107	3,360	5,905
Conif-Decid.	Regeneration	47,627	1.2							
"	Young	167,903	4.2	168,403	53,355	45,528	11,679	199,602	92,559	322,936
"	Immature	374,506	9.3	1,110,346	806,425	211,922	86,675	334,085	277,772	1,642,140
"	Mature	48,022	1.2	136,093	219,438	62,096	20,976	28,868	19,472	288,230
"	Overmature	1,857		6,280	11,955	225	675	17	107	11,520
Deciduous	Regeneration	215,655	5.4							
"	Young	458,340	11.4	95,760	17,595			7,699	11,004	3,149,220
"	Immature	526,600	13.1	281,890	191,583			24,359	38,077	7,185,556
"	Mature	28,416	0.7	13,001	12,472		937	1,076	308	471,989
"	Overmature	13,065	0.3	5,181	4,793		339	92	148	180,251
Decid-Conif.	Regeneration	55,969	1.4							
"	Young	293,555	7.3	269,282	99,300	126,226	15,530	77,265	51,604	1,064,335
"	Immature	569,360	14.2	1,342,319	1,098,284	93,590	81,573	140,410	183,220	4,729,693
"	Mature	25,306	0.6	64,475	81,833	4,365	4,161	3,567	1,605	277,404
"	Overmature	4,588	0.1	9,624	11,841	335	664			39,345
TOTALS		4,024,699	100.0%	4,814,521	3,205,807	1,369,227	665,238	2,878,367	1,085,953	19,651,066
Volume %				14.3%	9.5%	4.1%	2.0%	8.5%	3.2%	58.4%
Total Accessible		Acc.=21.1%								
and Inaccessible		19,086,756	In.=78.9%	25,007,691	15,153,191	5,074,160	4,711,858	35,268,180	9,794,772	71,776,693
Total Volume %				15.0%	9.1%	3.0%	2.8%	21.2%	5.9%	43.0%

Total Volume all Species Accessible and Inaccessible= 166,786,545 thousands of board feet.

TABLE IV—(Continued)

* Definitions

A coniferous cover type is one where 75% or more of the volume of the type is made up of coniferous species. The remaining 25% may be deciduous or coniferous.

A coniferous-deciduous cover type has 26% to 50% deciduous volume and 51% to 75% coniferous volume.

A deciduous-coniferous cover type has 51% to 75% deciduous volume and 26% to 50% coniferous volume.

A deciduous cover type has at least 75% deciduous volume. The balance may be coniferous.

Coniferous species include the true firs and douglas fir, larch or tamarack, the pines (lodgepole, jack, limber and whitebark) and the spruces (white, black and Engelmann).

Deciduous species include white poplar (trembling aspen), black poplar (balsam poplar, Balm of Gilead) and white birch.

Sw = white spruce

Sb = black spruce

Fb = balsam fir

P = pine

TABLE V
FOREST RESOURCES OF ALBERTA
VOLUME DISTRIBUTION—EASTERN ROCKIES FOREST RESERVE

Accessible	Thousands of Board Feet							
	All maturity classes and all cover types							
	Spruce		Lodgepole pine		Douglas Fir	Other Conif.	Deciduous	Total
4"-10" DBH	11" + DBH	4"-10" DBH	11" + DBH					
Volumes	1,203,720	2,055,060	4,661,580	1,210,860	128,940	31,080	417,900	10,066,140
Volume %	12.0%	20.4%	46.3%	12.0%	1.3%	0.3%	4.2%	100%

No volumes have been compiled for the inaccessible portion of the Reserve.

TABLE VI
SHIPMENTS OF SAWN LUMBER FROM ALBERTA, 1946 TO 1954
(As compiled by the Dominion Bureau of Statistics)
(Reporting Operators only)
In Thousand Feet Board Measure

Year	To New Brunswick	To Quebec	To Ontario	To Manitoba	To Saskatchewan	To Alberta	To British Columbia	Total to Canada	To United States	To United Kingdom	To Other Countries	Total Shipments	Total Shipments as a % of L. & F. Production
1946	288	700	220	2,841	17,172	120,074	2,078	143,373	19,392	27	822	163,614	42.39
1947	41	803	1,691	7,090	21,605	134,298	566	166,094	26,121	2,761	500	195,476	43.02
1948	-----	631	12,096	11,957	13,511	138,602	675	177,472	48,587	-----	-----	226,059	45.04
1949	-----	146	14,905	6,799	16,495	122,995	103	161,443	22,362	-----	-----	183,805	39.74
1950	-----	24	8,173	10,329	16,195	125,650	-----	160,371	60,197	-----	-----	220,568	63.65
1951	-----	464	13,405	10,890	17,481	132,256	72	174,568	61,311	66	-----	235,945	47.10
1952	-----	187	6,726	10,358	21,214	160,285	155	198,925	81,295	-----	-----	280,220	57.46
1953	-----	563	8,889	6,161	21,722	146,289	455	184,079	75,320	366	-----	259,765	54.03
1954	-----	127	5,975	6,143	19,984	148,458	215	180,902	111,243	1,062	35	293,242	66.49
													Av. 50.99
													Av. 136,545

SHIPMENTS OF SAWN LUMBER TO ALBERTA, 1946 TO 1954
(Reporting Operators Only)
In Thousand Feet Board Measure

Year	From Quebec	From Ontario	From Manitoba	From Saskatchewan	Total from Provinces excluding B.C.	From British Columbia	Total Shipments
1946	43	69	657	1,596	2,365	n.a.	n.a.
1947	-----	218	-----	635	853	81,148	82,001
1948	66	190	-----	-----	256	72,827	73,083
1949	90	10	-----	-----	100	82,824	82,924
1950	173	30	-----	-----	203	75,177	75,380
1951	227	75	-----	-----	302	75,040	75,342
1952	152	32	-----	-----	184	93,671	93,855
1953	198	74	-----	-----	272	105,704	105,976
1954	31	-----	15	-----	46	101,788	101,834

TABLE VII

A comparison of production as reported by the Dominion Bureau of Statistics from reporting operators only and production as reported by the Department of Lands and Forests from returns of timber berths and special timber permits etc., for the years 1946 to 1954 inclusive.

	D.B.S. Production	Lands and Forests Production	D.B.S. as % of Lands and Forests
1946 -----	255,675,000	385,938,234	66.25
1947 -----	283,478,000	454,370,761	62.39
1948 -----	339,574,000	501,912,157	67.66
1949 -----	306,353,000	462,498,784	66.24
1950 -----	331,097,000	346,541,307	95.54
1951 -----	398,295,000	500,905,880	79.51
1952 -----	409,570,000	487,664,968	83.99
1953 -----	400,822,000	480,751,553	83.37
1954 -----	359,556,000 preliminary	441,044,504	81.52
			Av. 76.27

ANNUAL PRODUCTION of LUMBER, RAILWAY TIES, & MISCELLANEOUS PRODUCTS

ALL PRODUCTS CONVERTED TO THOUSANDS OF BOARD FEET

MEASURE FOR COMPARISON

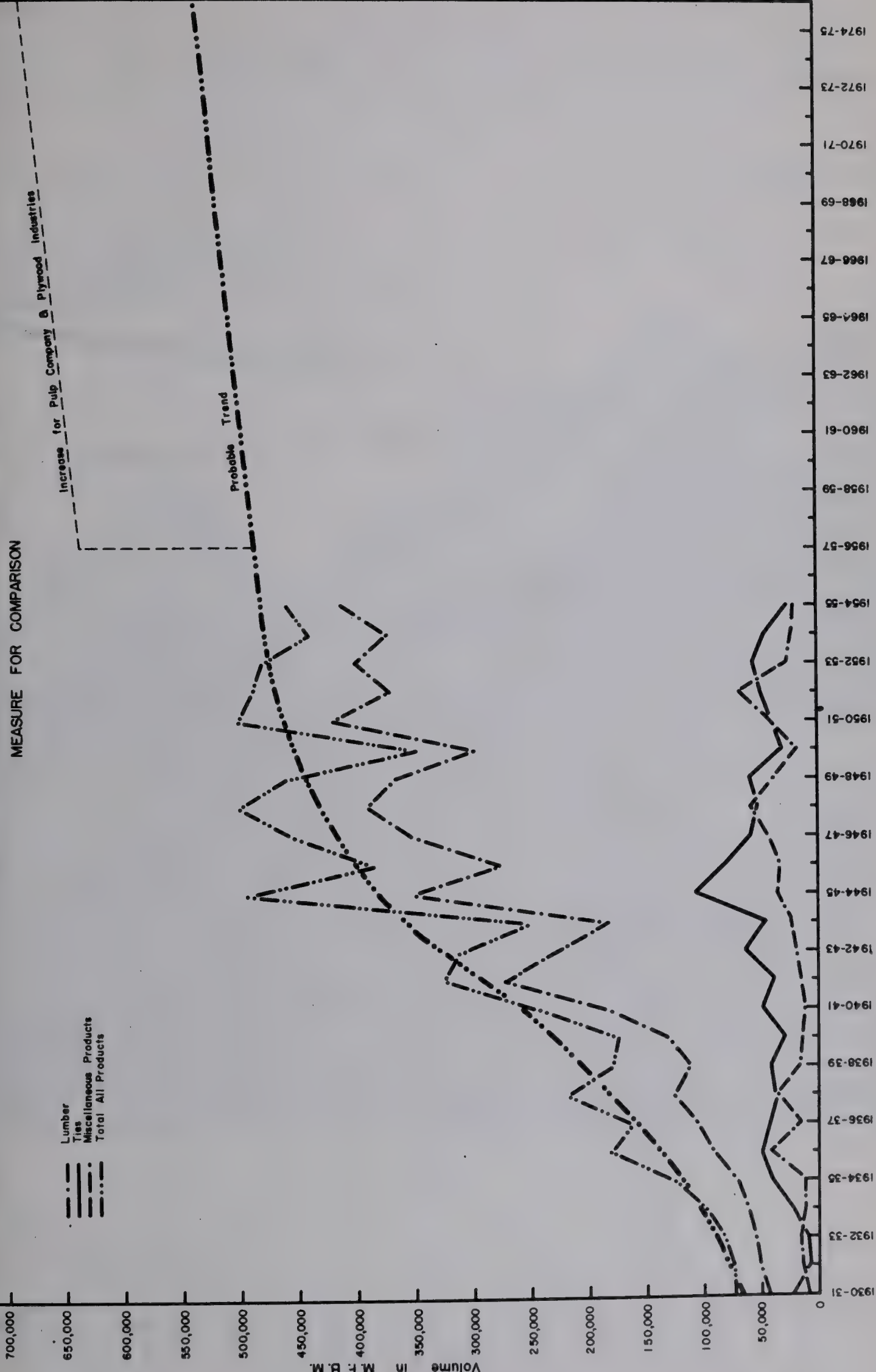
- Lumber
- Ties
- Miscellaneous Products
- Total All Products

Probable Trend

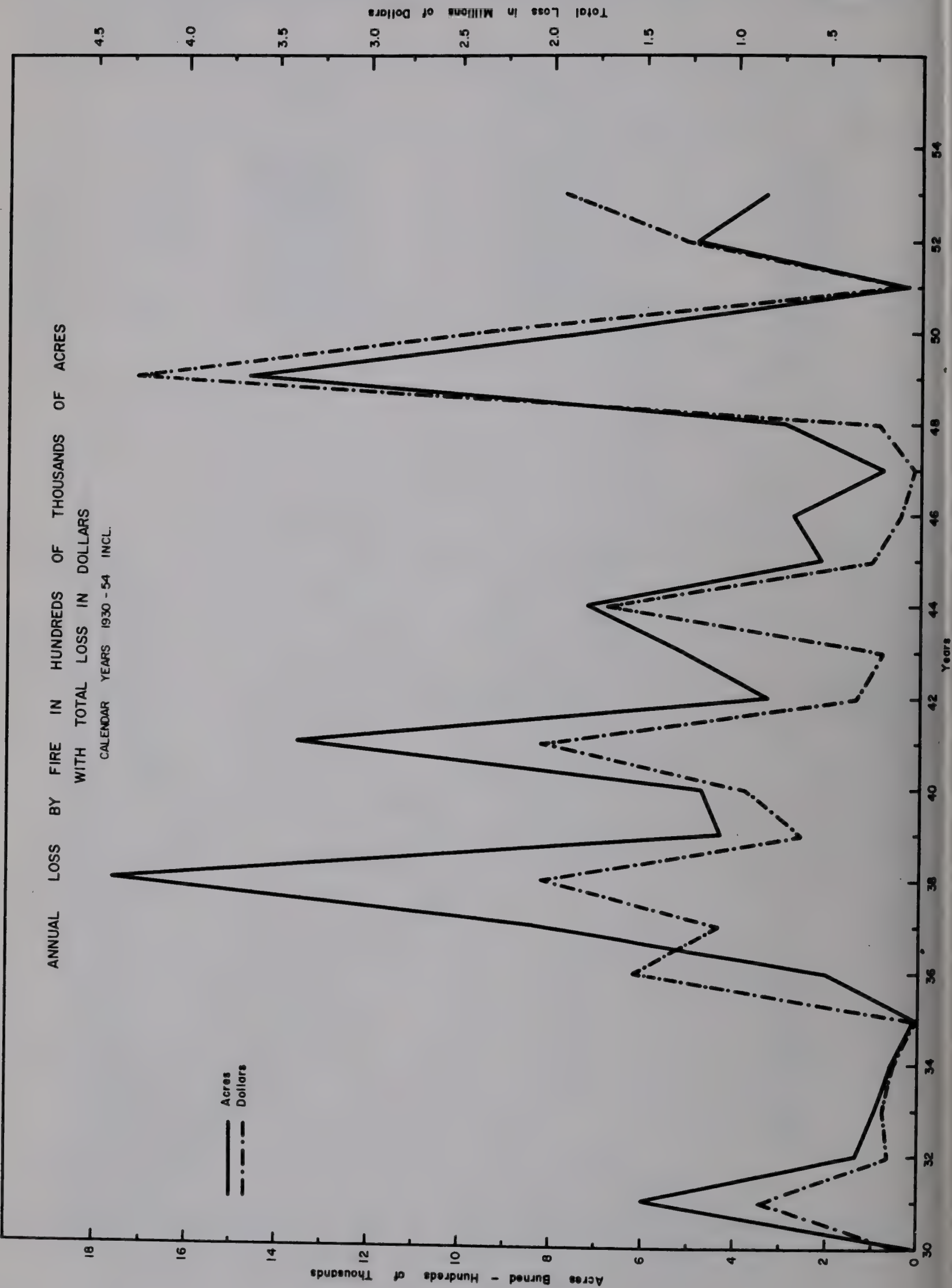
Increase for Pulp Company & Plywood Industries

GRAPH 1

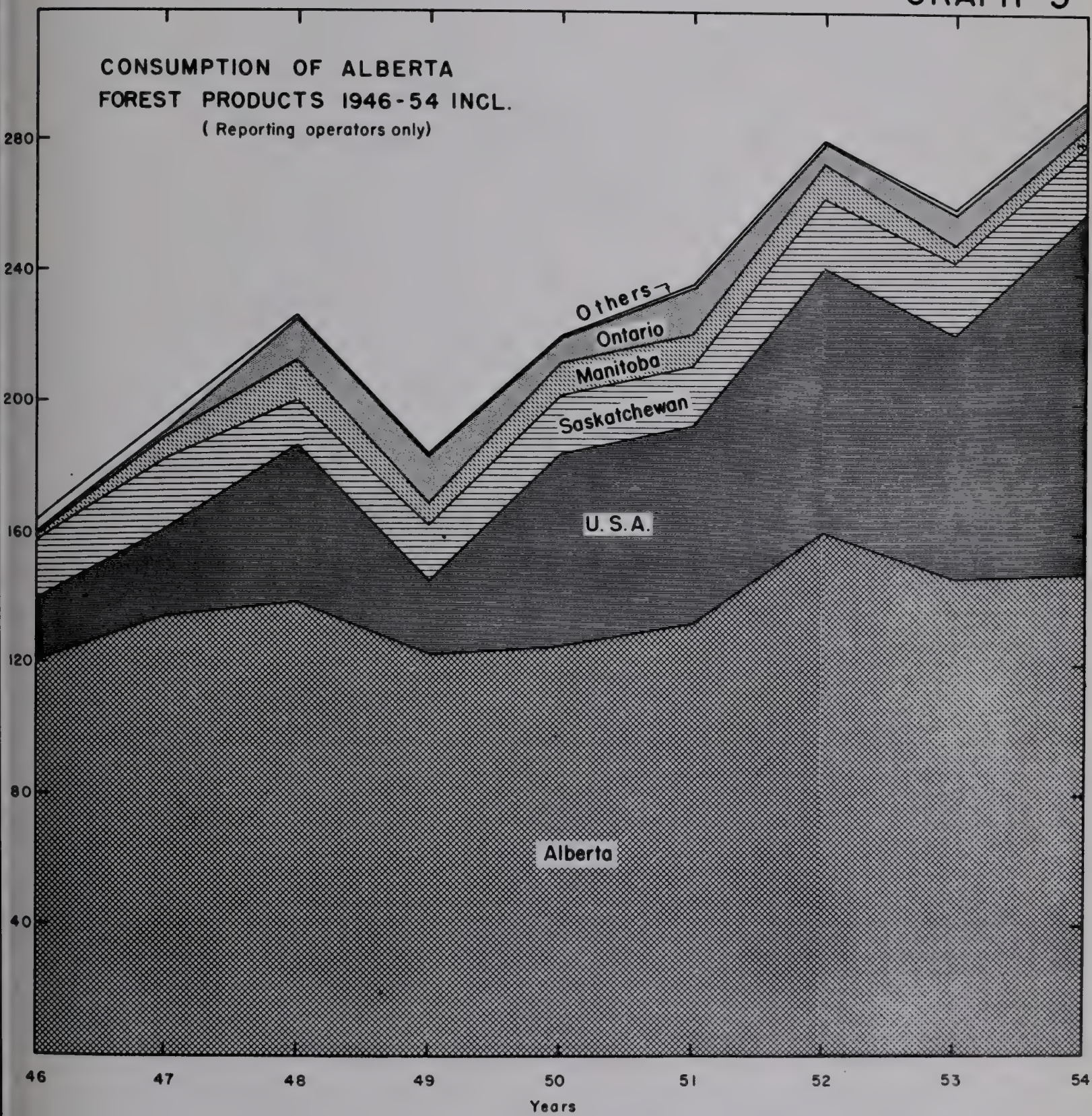
Years



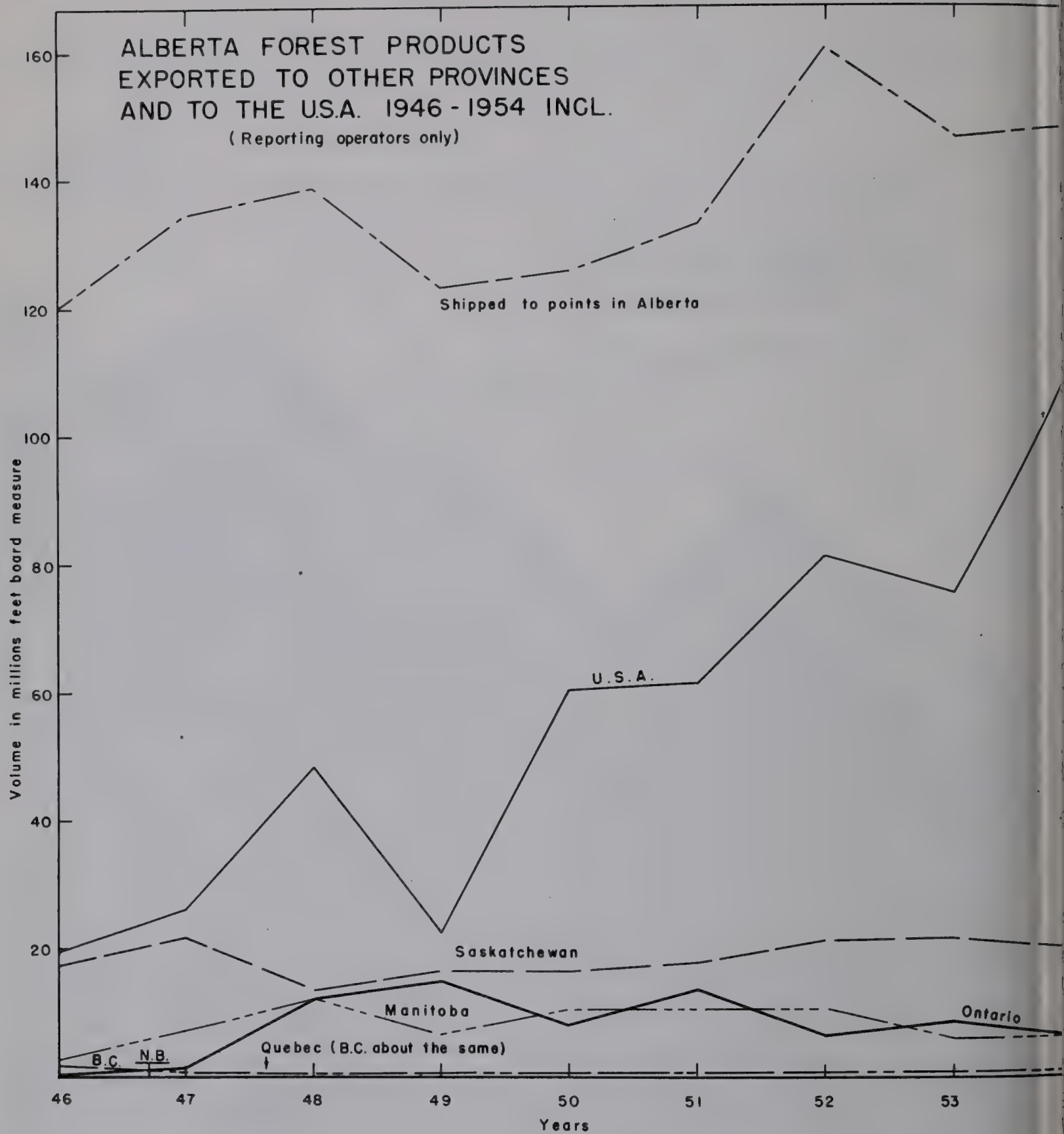
GRAPH 2



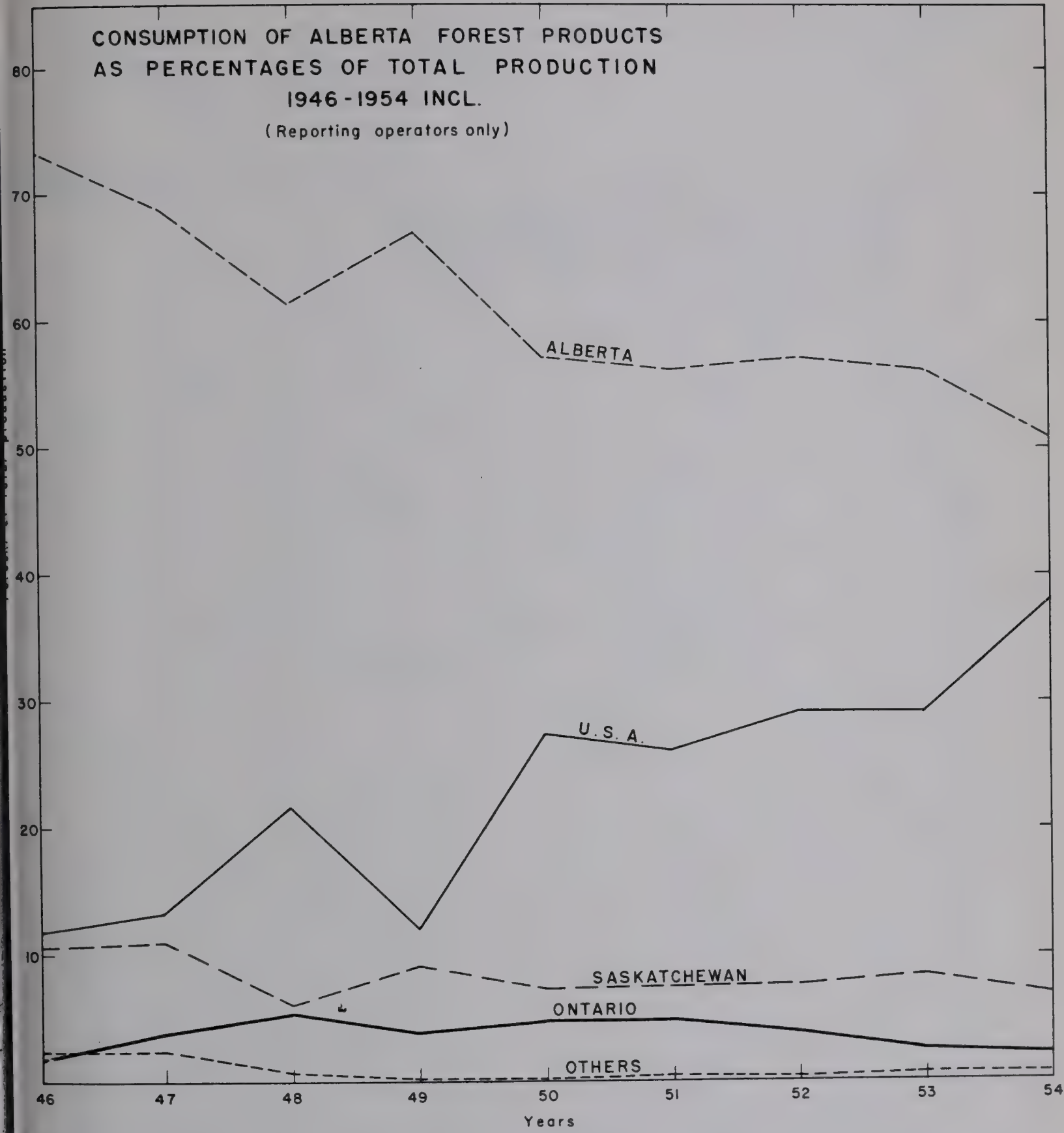
GRAPH - 3

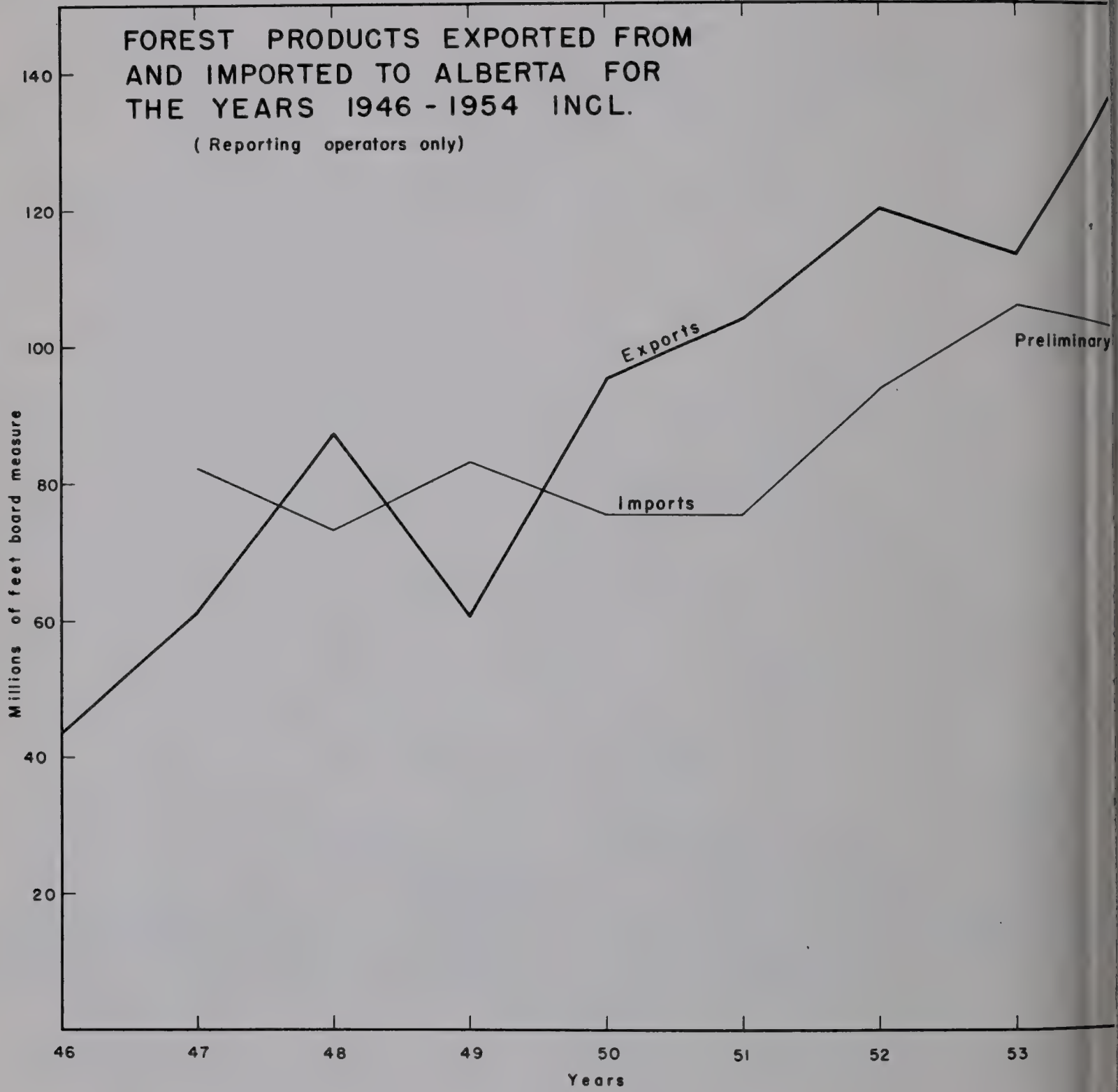


GRAPH 4

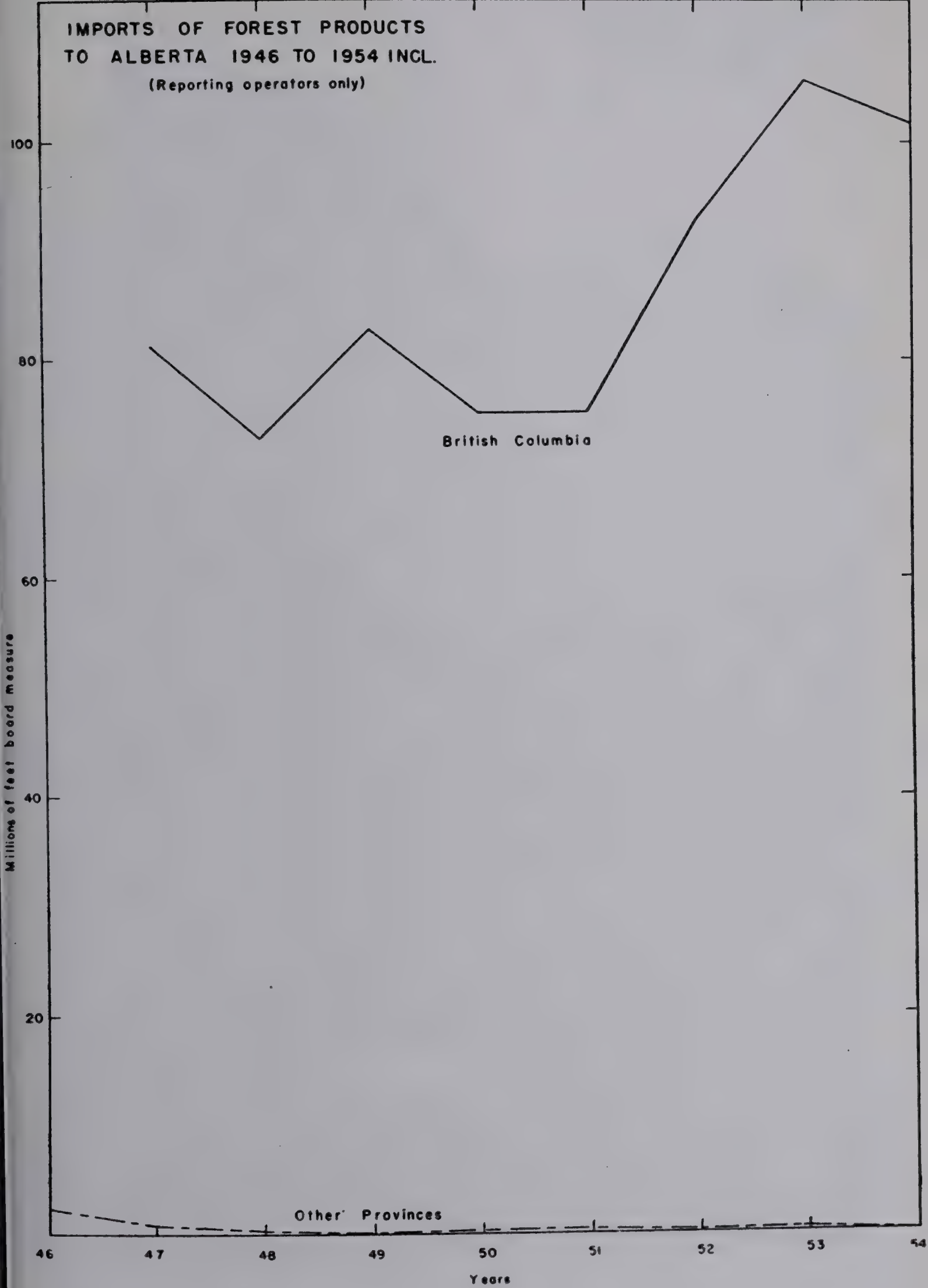


GRAPH - 5

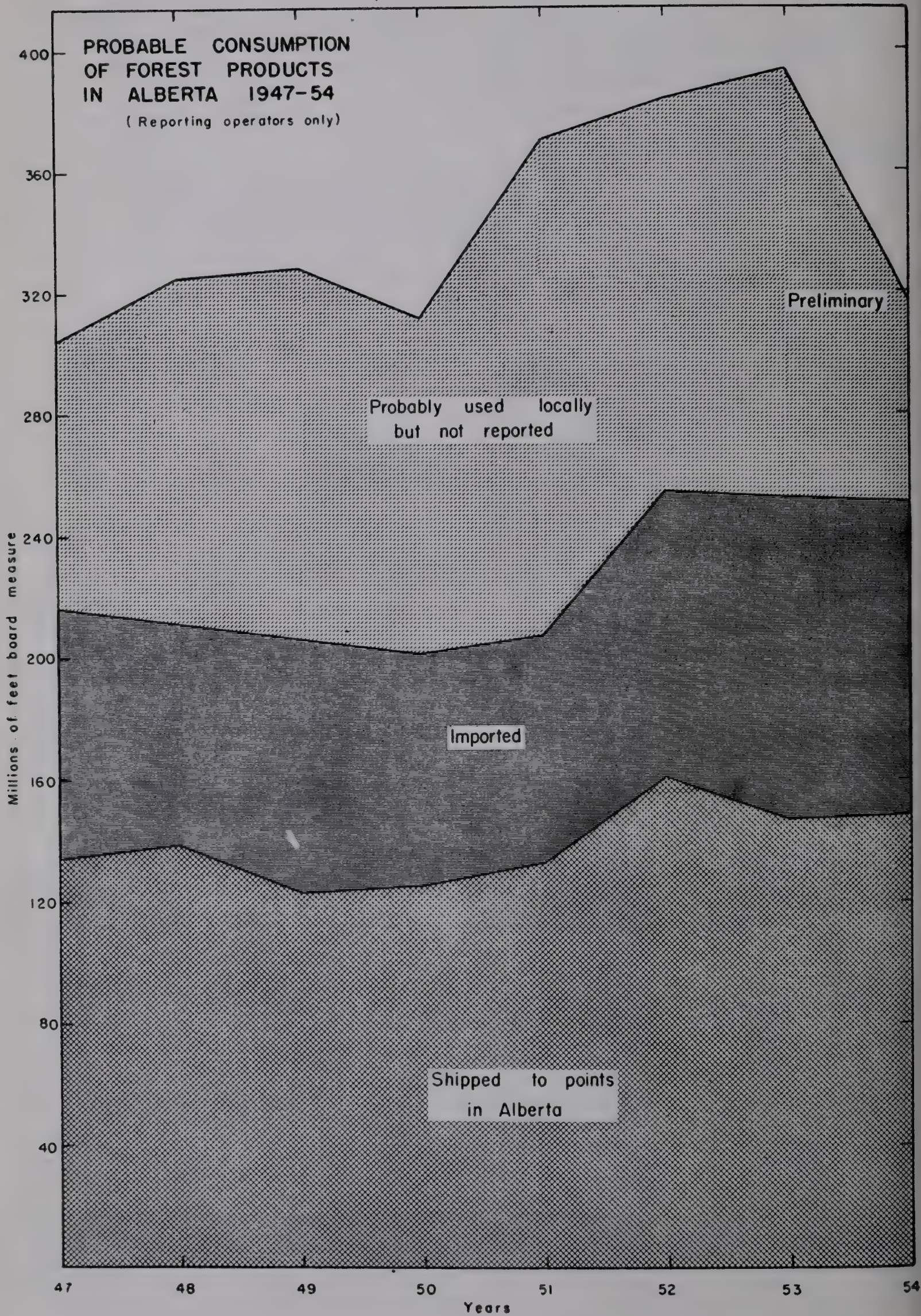


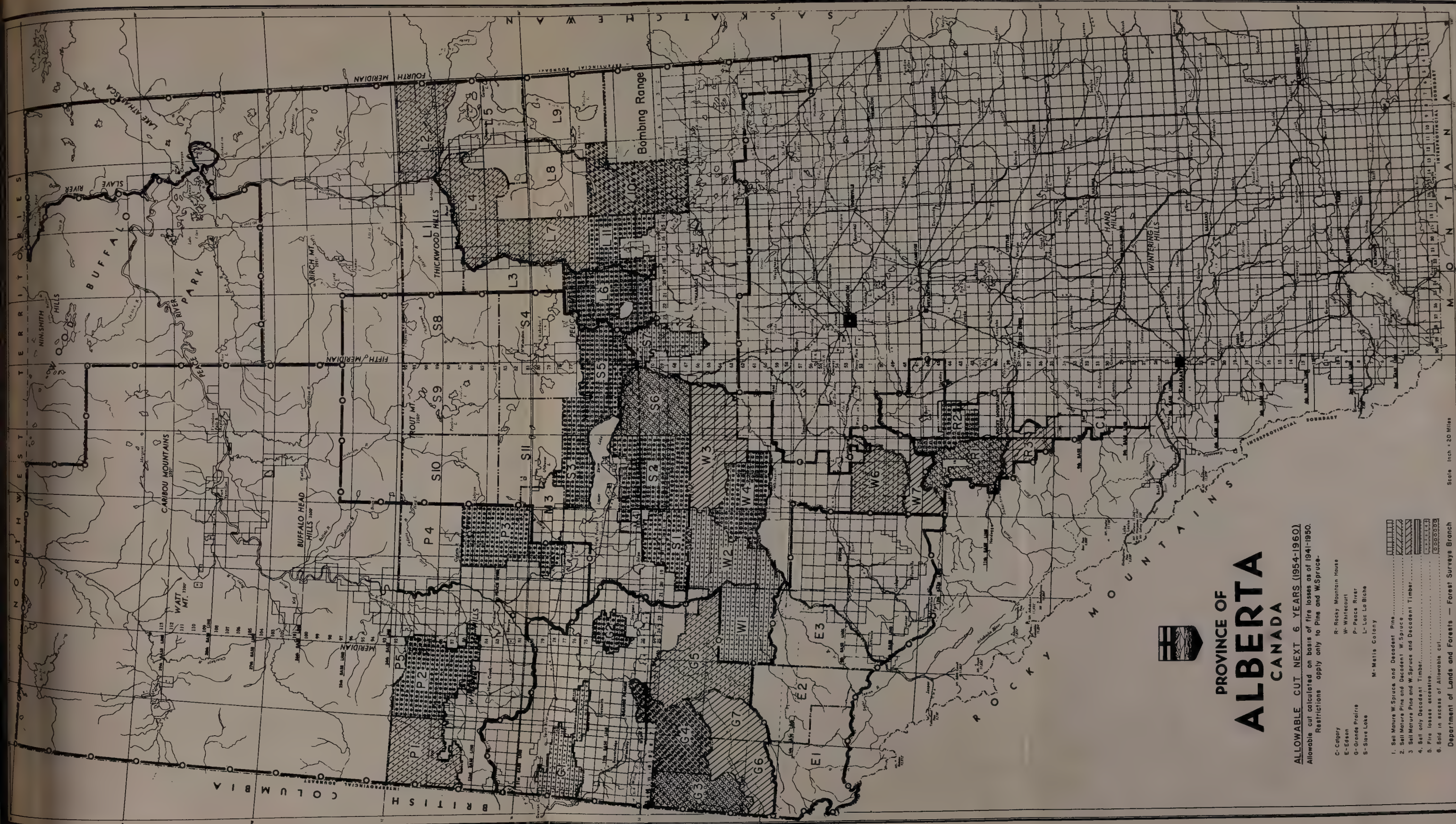


GRAPH 7



GRAPH - 8





PROVINCE OF
ALBERTA
CANADA

ALLOWABLE CUT NEXT 6 YEARS (1954-1960)
Allowable cut calculated on basis of fire losses as of 1941-1950.

Restrictions apply only to Pine and W.Spruce.

- | | |
|-------------------|-------------------------|
| C- Calgary | R- Rocky Mountain House |
| E- Edson | W- Whitecourt |
| G- Grande Prairie | P- Peace River |
| S- Slave Lake | L- Lac La Biche |
| | M- Mallett Colony |
-
- | | |
|---|--|
| 1. Sell Mature W.Spruce and Decadent Pine | 11. Sell Mature W.Spruce and Decadent Pine |
| 2. Sell Mature Pine and Decadent W. Spruce | 12. Sell Mature Pine and Decadent W. Spruce |
| 3. Sell Mature Pine and W. Spruce and Decadent Timber | 13. Sell Mature Pine and W. Spruce and Decadent Timber |
| 4. Sell only Decadent Timber | 14. Sell only Decadent Timber |
| 5. Fire losses excessive | 15. Fire losses excessive |
| 6. Sold in excess of allowable cut | 16. Sold in excess of allowable cut |

Department of Lands and Forests — Forest Surveys Branch

Scale 1 inch = 20 Miles

ALBERTA'S ECONOMIC PROSPECTS

SURVEY OF PRODUCTION

1952 and 1975

Prepared by

Alberta Bureau of Statistics
Department of Industries and Labour

D. I. Istvanffy, Statistician
W. G. Brese, Analyst.

DEPARTMENT OF INDUSTRIES AND LABOUR

HON. R. REIERSON,
Minister

J. E. OBERHOLTZER,
Deputy Minister

December, 1955

SUMMARY

1. By 1975 it is estimated that the net value of production will rise to \$1,700 per capita, a substantial increase over the average net production of \$1,094 per capita recorded in 1952.

2. The shift in the relative importance of the various commodity producing industries is significant. According to present estimates mining and manufacturing production will exceed agriculture in both relative and absolute terms.

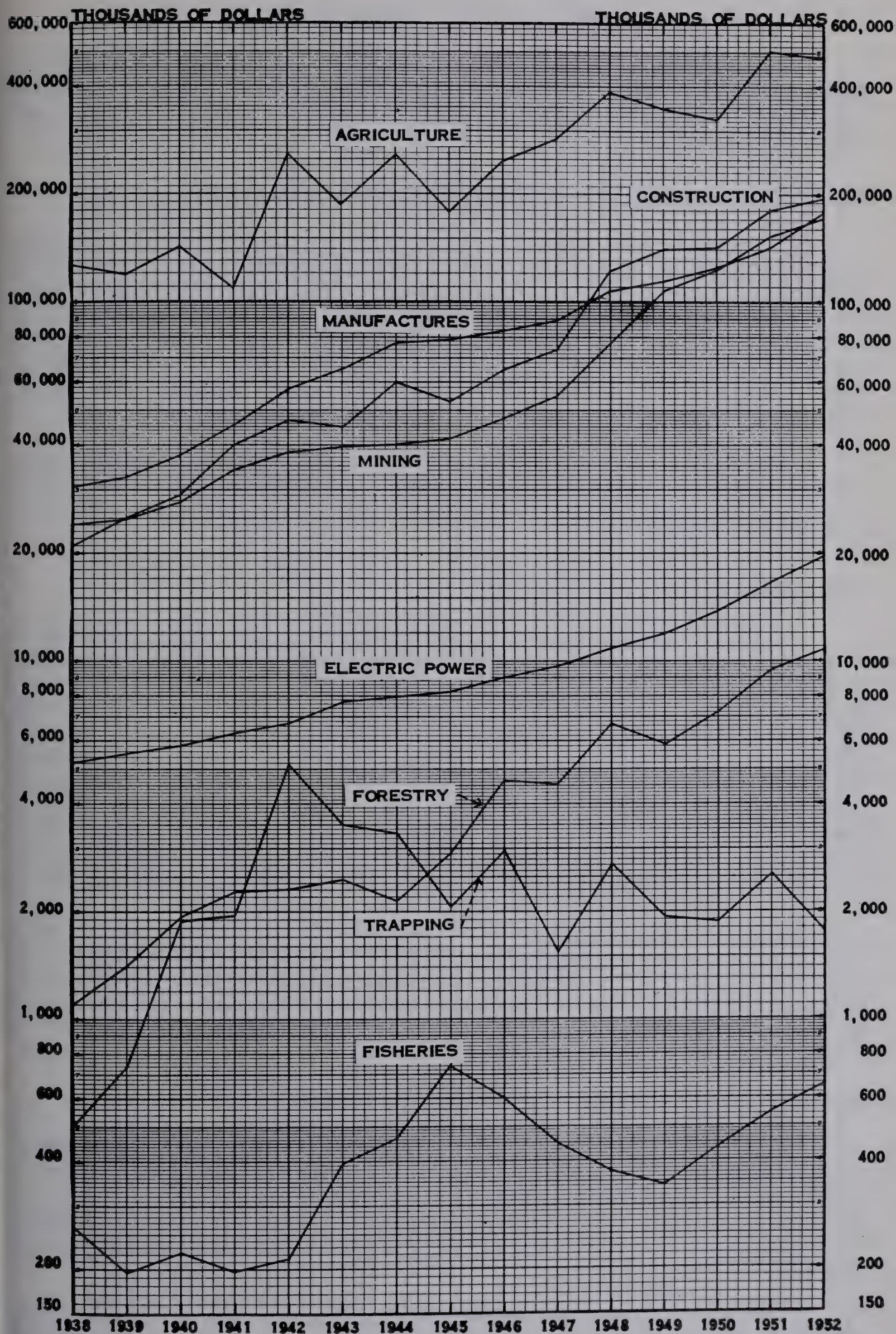


CHART 1. NET VALUE OF PRODUCTION BY INDUSTRIES, ALBERTA, 1938-1952

NET VALUE OF PRODUCTION

To summarize the changes that are expected in the economy of the province by 1975 the estimates of production which have been made by various departments for specified sectors of the economy have been combined in this section.

PRODUCTION: PRIMARY AND SECONDARY INDUSTRIES:

"Production" is commonly understood to mean either the activities involved in putting actual commodities into useful form or the commodities themselves after they have been produced. Accordingly, the term includes such processes as growing crops, catching fish, generating electricity, constructing buildings, and manufacturing goods. Other activities such as transportation, communication, finance, trade and other services, although vital to the economy, are not included in production except to the extent that they contribute to the value of the goods produced.

Agriculture, mining (which includes petroleum and natural gas), fishing, trapping, lumbering, and generation of electricity, are the primary producing industries, while construction and manufacturing are said to be secondary industries.

GROSS VALUE OF PRODUCTION:

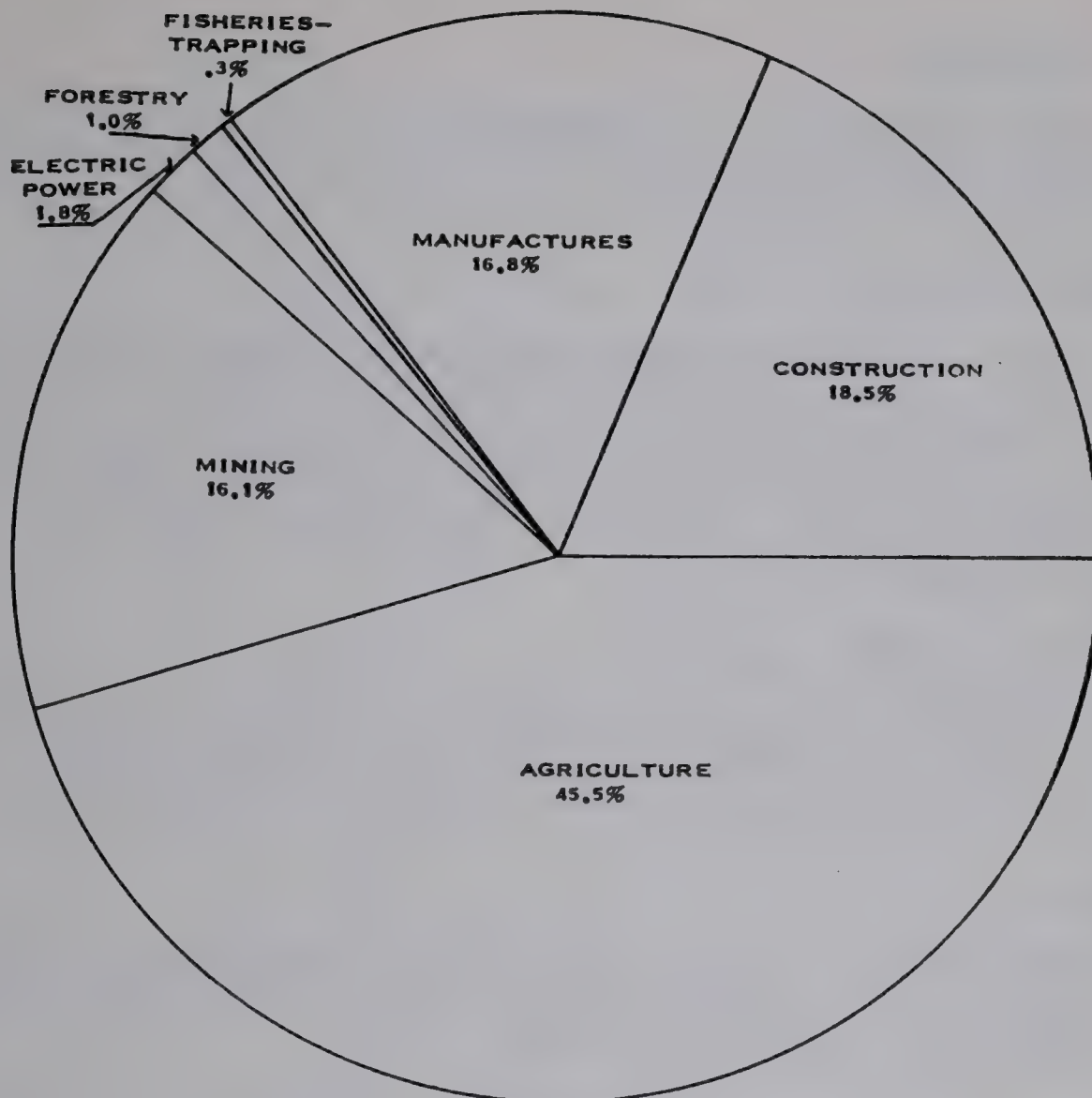
Various methods have been used to measure the value output of all industries. For instance, a figure called the gross value of production may be obtained by adding together the values of goods produced in the eight industries. However, such a figure contains many duplications. For example, the value of logs could be included first in the forest industry, again in the manufacturing industry after passing through a sawmill, and finally in the construction industry as part of the value of the finished structure. Or again, crude oil is produced in the mining industry, refined into fuels in the manufacturing industry, and finally used in, perhaps, the agricultural industry. In each case if the gross values of all three industries were added, the same material would be included three times, causing a distorted figure.

In addition to the duplication between industries there can be duplications in a single industry. In the case of agriculture, for example, some of the grain produced (and included in the total production of field crops) is fed to livestock. Thus the total value of field crops plus the total value of livestock and livestock products would over-estimate total agricultural production.

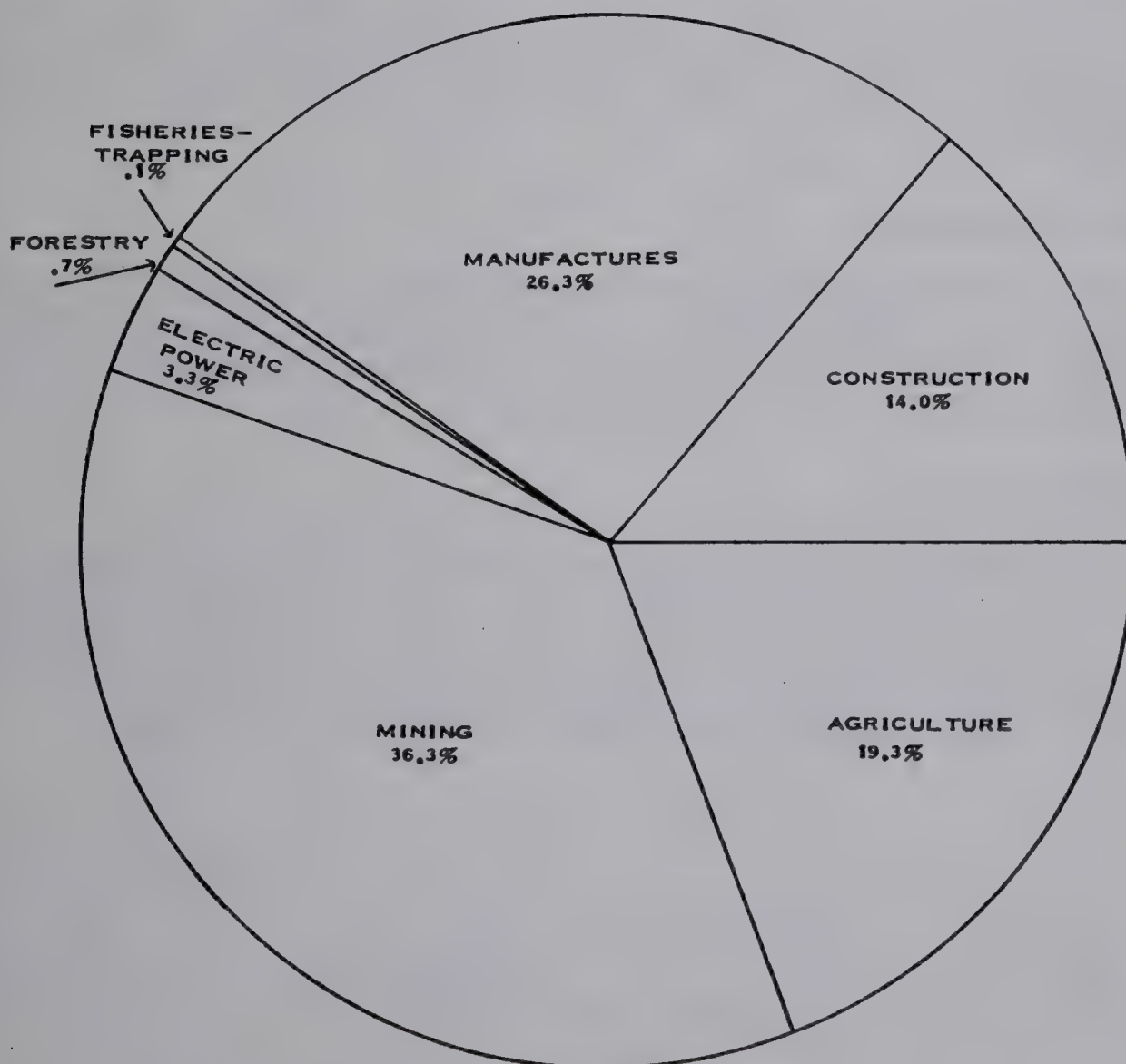
NET VALUE OF PRODUCTION 1952 AND 1975:

The net value of production which measures only the value added to total production by each industry has been chosen as the most satisfactory indicator of the relative importance of each industry. This measure is obtained by deducting from the total value of output the cost of materials, fuel, purchased electricity, and process supplies, consumed in the production process.

The percentage contribution of each of the commodity producing industries to Alberta's total net value of production is shown on Chart 2, which shows the proportion of each to the total in 1952, and the estimated proportions which will be contributed by each in 1975.



1952



1975

2. NET VALUE OF PRODUCTION BY INDUSTRIES, ALBERTA, 1952 AND 1975 ESTIMATED

AGRICULTURE:

The net value of agricultural production is expected to average about \$500 million annually by 1975. The proportionate net value would drop from 45.5 per cent to about 19.3 per cent over the period.

MINING:

The net value of mineral production is expected to show the sharpest rise of any sector of the economy. The relative proportion is expected to increase from 16.1 per cent to 36.3 per cent, and the net dollar value of production to increase from \$171.1 million in 1952 to \$940 million by 1975. This increase would be due mainly to increased production of crude petroleum and natural gas.

ELECTRIC POWER:

The proportionate net value of electric power production is expected to approximately double from 1.8 per cent to 3.3 per cent, with the absolute net value rising from \$19.5 million to \$85 million over the period.

FORESTRY:

Although the net value of forestry production is expected to rise in absolute terms from \$10.8 million to \$17 million, the proportion would drop from 1 per cent to 0.7 per cent.

TRAPPING AND FISHERIES:

No substantial dollar increase is expected in the value of the trapping and fisheries industries from the \$2.4 million in 1952; hence the proportionate net value would drop from 0.3 per cent to less than 0.1 per cent.

MANUFACTURING:

The absolute net value of manufacturing production is expected to quadruple from \$178.2 million in 1952 to \$680 million by 1975, but the percentage increase would be in the neighbourhood of only 10 per cent, rising from 16.8 per cent to 26.3 per cent.

CONSTRUCTION:

Examination of the historical record of the proportion of construction activity to the total economy of the province suggests that an average figure of about 14 per cent of the total net value of production should be maintained. This would entail a rise in absolute terms from about \$200 million to an average of approximately \$360 million by 1975.

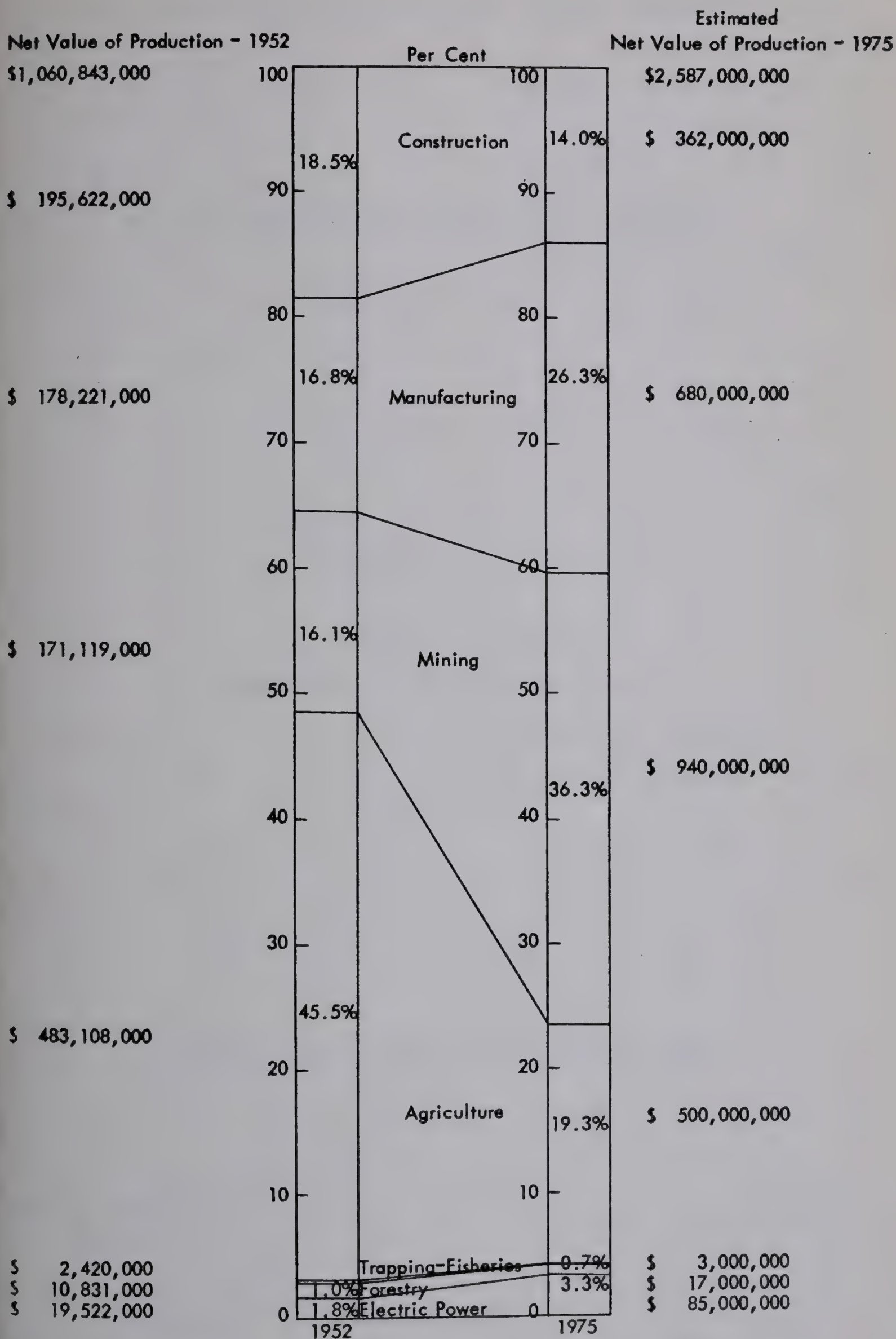


Chart 3. Net Value of Production - By Industries - Alberta, 1952 and 1975 (estimated)



ALBERTA'S ECONOMIC PROSPECTS

MANUFACTURING INDUSTRIES—ALBERTA

1953 and 1975

Prepared by

Alberta Bureau of Statistics
Department of Industries and Labour

D. I. Istvanffy, Statistician,
W. G. Brese, Analyst.

DEPARTMENT OF INDUSTRIES AND LABOUR

HON. R. REIERSON,
Minister

J. E. OBERHOLTZER,
Deputy Minister

December, 1955.

S U M M A R Y

Increased industrialization is essential to cushion income fluctuations inherent in an economy where agriculture predominates. This objective can be achieved by:

- a) encouraging decentralization of Canadian manufacturing firms.
- b) equalization of the burden of transportation charges.
- c) placing emphasis on industrialization rather than on the exporting of raw materials and the importing of finished goods.

MANUFACTURING INDUSTRIES

It is hoped that the Commission will urge the Federal Government to consider favourably every proposal which will aid in speeding the industrialization of Western Canada.

The economic basis of the Prairie Provinces has been largely agricultural. The vulnerability of this type of economy was exposed during the depression years of 1929-39 and only the firm markets of the war and immediate post-war years for agricultural produce relieved the situation. Before 1940 the Prairie's economy was largely subject to the vagaries of the world market for grains. By 1955 an ever increasing proportion of the population rely on salaries and wages from industrial, commercial and mining activities and there is less dependence on returns from agriculture.

1. Prairie government leaders advocate industrialization in order to reduce the vulnerability of the area to economic recessions. It would benefit Canada, and certainly Alberta, were consideration given to decentralization of industry by the management of the larger manufacturing firms of eastern Canada. The increasing population of western Canada provides growing markets and is capable of satisfying the demands for a larger industrial labour force. Raw materials such as petroleum, natural gas, coal, limestone, sulphur, salt, and lumber, etc. are abundant. Power resources of oil, gas, hydro, and coal, are almost unlimited.

a) National defence and sociological considerations confirm the wisdom of dispersal of industry.

2. The railway freight rate structure has been both a boon and deterrent to western manufacturers. Plants serving local markets have been established which have had protection in the form of relatively high freight rates on the imports of finished manufactured goods. It has been possible to bring in textiles, paper, iron and steel, and to further manufacture and adapt them for local use. Where local sources of raw materials have been or become available, as in the case of the manufacture of agricultural products or refined petroleum products, distant manufacturers have had to pay heavy freight tariffs and have found difficulty in competing. At the same time high railway freight rates hitherto have militated against prairie manufacturers competing in continental and world markets.

The completion of the St. Lawrence Seaway, which will enable ocean going vessels to dock at Fort William, should do much to right the balance. Not only will local manufacturers and consumers be able to secure raw materials and consumer goods more cheaply but manufactured goods leaving the prairies will avoid trans-shipping costs and freight charges will be subject to effective competition.

3. Under the impetus of the favourable conditions of the post-war period and sparked and engendered by the discovery of vast crude oil reserves on the prairies, there was a significant increase in the volume of manufacturing production in Alberta over the decade 1946 to 1955. New industries which could not possibly have been forecast at the end of the war have become firmly established. Firms established at that time have been enabled to expand their production significantly and to diversify operations. Between 1941 and 1953 the gross value of manufacturing in Alberta increased from \$142 million to \$556 million.

Taking into consideration the normal expansion of markets which will follow population growth and the fact that it should be possible in the future to manufacture on the prairies for world markets, it is expected that the gross value of production of Alberta manufacturers will rise to approximately \$1,580 million by 1975. In other words, production is expected to triple in the next 20 years.

It is expected that there will be significant changes in the relative proportions produced by the various industrial groups of the province.

FOODS AND BEVERAGES:

The gross value of production of the foods and beverages group should rise in proportion to population growth to approximately \$450 million by 1975.

IRON AND STEEL:

The value of goods presently produced by the iron and steel industry of the province should approximately triple to about \$100 million by 1975.

PETROLEUM PRODUCTS:

Experts in the petroleum refining industry expect that production will triple to \$270 million by 1975.

CHEMICAL INDUSTRY:

The greatest increases will be in the chemicals and chemical products industry. Annual production is expected to rise from approximately \$14 million (1953) to over \$400 million by 1975. This particular industry is felt to be so important that it has been given special treatment in the following section.

Normal expansion which can already be visualized for the other industrial groups should boost the gross value of manufacturing production to \$1,580 million by 1975.

ALBERTA'S ECONOMIC PROSPECTS

THE PETROCHEMICAL INDUSTRY

Prepared by

Research Council of Alberta

Donald Quon

Senior Research Chemical Engineer

RESEARCH COUNCIL OF ALBERTA

HONOURABLE GORDON E. TAYLOR,
Chairman

N. H. GRACE,
Director

December, 1955.

THE PETROCHEMICAL INDUSTRY

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II - E2. THE PETROCHEMICAL INDUSTRY

SUMMARY

The petrochemical industry—which produces largely synthetic organic chemicals—has enjoyed a phenomenal growth in the last fifteen years and has emerged as one of the major basic industries of America. This expansion is likely to continue at a rapid pace as synthetic organic chemicals replace more and more natural products in such applications as clothing, rubber goods, soaps, medicines, and building materials. Petroleum and natural gas hydrocarbons appear to be ideal raw materials for organic syntheses—being plentiful, cheap, and extremely versatile chemically.

An authoritative forecast of U.S. petrochemical production for the next twenty years has been prepared by the President's Materials Policy Commission. It predicts a nearly three-fold increase in the industry from 1955 to 1975 but does indicate a declining growth rate (from 7.8 per cent annually in 1955 to 3.5 per cent by 1970) as the industry approaches maturity.

A survey of the Canadian chemical (and petrochemical) industries shows: (1) that the American and Canadian growth rates are about the same, and (2) that the production and use patterns are basically similar although there is a 5 to 10 year lag in the Canadian development. With the existing tariff structure and with the growing strength of the Canadian chemical industry, it is likely that the Canadian production of chemicals should keep pace with, if not exceed, the chemical needs of the national economy. It was, therefore, decided to apply the Commission's projected growth rates to the Canadian petrochemical industry, but with a 5 year lag. Since the capital worth of the industry now is about \$300,000,000, this means that a billion dollar industry is forecast for 1975, with an estimated production of some \$800,000,000 annually. Even with this large growth, however, the hydrocarbon requirements of the petrochemical industry will be small compared to the fuel requirements—only about 3 to 4 per cent of the total gas produced, and around 2 to 3 per cent of all the crude oil refined will be required as chemical raw materials.

The pattern of Canadian petrochemical growth is expected to follow these general lines—those processes, making high value end products and based on high methane content natural gas, will find Alberta economically attractive; those processes, based on aromatics from petroleum fractions, will likely build in Eastern Canada; the location of those processes, based on the higher paraffin hydrocarbons available from either natural gas or refinery off-gases, will depend on existing local economic conditions.

Alberta now possesses, in terms of capital expenditures, about 40 per cent of Canada's petrochemical industry. There are reasons to believe that this figure will rise to 45 per cent in the long term. Projection of Alberta's petrochemical growth suggests an industry worth some \$450,000,000 by 1975, with an annual production of about \$360,000,000.

I. INTRODUCTION

The growth of the petrochemical industry on this continent in the last decade and a half can only be described as phenomenal and the industry has emerged as one of the major basic American industries, taking its place alongside such giants as automobile, steel, petroleum, pulp and paper, and electronics.

In trying to assess Alberta's potentialities in this field, one must necessarily lean heavily on the American experience. There is no doubt that the initial impetus for the tremendous development of the American Southwest was provided by oil and gas exploration and production. However, a great deal of the subsequent industrial expansion has been due to petrochemical growth. It must be remembered that in developing an oil field, once the exploration and drilling phases are over, only a comparatively small labor force is required to produce the oil and gas. If an oil-producing region is to maintain a high level of industrial activity and is to build a broad stable industrial base, then the oil and gas must be processed as raw materials right at the source. This means refineries and petrochemical plants. However, refineries, for economic reasons, must be located near the large urban markets (either geographically or transportation-wise) and, therefore, tend to parallel and follow population growth. On the other hand, petrochemical industries can lead and promote growth and development.

Any prediction of the future growth of an industry is necessarily speculative, governed and qualified as it is by untested and unprovable assumptions. Accurate forecasts are especially difficult for the petrochemical industry—an industry with such a short history that past experience is no sure guide to the future, an industry where sudden and abrupt technological changes are normal, an industry whose markets are continually branching into new and hitherto untapped fields. However, even if the forecasts should turn out to have only qualitative rather than quantitative significance, they would still form a valuable guide in the overall assessment of Alberta's economic prospects. For, make no mistake about it, the petrochemical industry holds the key to Alberta's industrial future.

This present study proposes to review the present technology of the petrochemical industry, examine the availability of hydrocarbons for usage as chemical raw materials, forecast Canada's petrochemical development for the next 20 years, and estimate Alberta's share in that development.

II. THE TECHNOLOGY OF PETROCHEMICALS

A petrochemical may be defined as a chemical that is produced from petroleum and natural gas, or their products, but which is not used for fuel purposes. The two primary raw materials for the manufacture of petrochemicals are, first, natural gas and second, refinery products, which include certain petroleum fractions which yield aromatics* and refinery off-gases. Any petrochemical development in Alberta will be based, to a very large degree, on natural gas so that attention will be focussed on this material source. All four hydrocarbon components of natural gas, methane, ethane, propane and butane (arranged in order of increasing molecular weight) are members of the same chemical family, the paraffin hydrocarbons. However,

*A glossary of chemical terms will be included in the back of this section.

they exhibit different degrees of reactivity and they have their own individual use patterns. Ethane, propane, and butane can be readily extracted from natural gas and can be made available in fairly pure states. These three hydrocarbons are also found in large quantities in refinery off-gases. For those petrochemical processes using any or all of these raw materials, the choice of the source is governed by economic rather than technological reasons. Those processes requiring methane in large quantities must use natural gas.

Natural gas can be divided roughly into two categories — “wet” gas, which contains economically recoverable amounts of the higher paraffin hydrocarbons (ethane, propane, and butane) and “dry” gas, which is essentially a high methane content gas. “Wet” gas must be processed and converted into a “dry” gas before it can enter long distance gas transmission lines.

A chart of the major chemical intermediates and end products that may be derived from natural gas is given in Figure 1. This does not, of course, come close to representing the myriad of chemicals that may be produced. It is not proposed to go into any detail concerning the various chemical processes involving natural gas hydrocarbons. Since these processes are changing so rapidly, an understanding of the broad technological trends is actually more useful in assessing growth and potential.

The chemical uses of natural gas may be divided into three groups*:

1. Processes Involving High Methane Gas

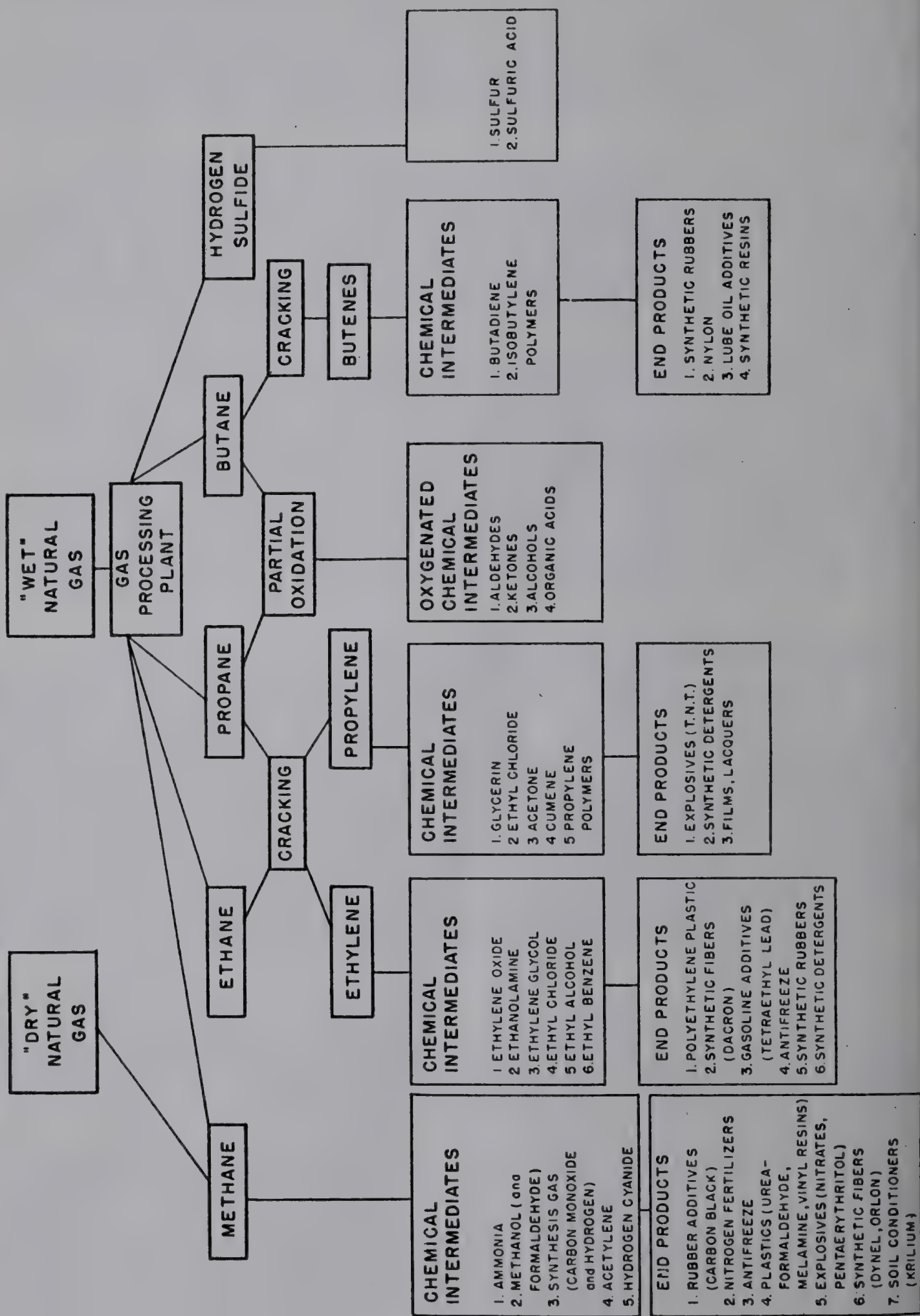
At the present time, the largest single non-fuel use of natural gas is the carbon black industry. Carbon black, in various grades depending upon the process, is used in large quantities for compounding rubbers. In the past, the carbon black industry has been predicated upon cheap natural gas. With the increase in gas prices and with the development of new types of synthetic rubbers requiring blacks produced from petroleum fractions, it appears as if the production of carbon black from natural gas will suffer a sharp decline in the coming years. However, the manufacture of carbon black has never represented a really “efficient” use of natural gas and the dollar value of production has never been commensurate with the amount of gas used.

High methane natural gas is a source of a number of chemical intermediates — materials which undergo further reaction before yielding end products. One of these is the so-called “synthesis gas”, a mixture of carbon monoxide and hydrogen, produced by the incomplete combustion of natural gas with oxygen. This “synthesis gas” can be used to produce methanol, and hence formaldehyde, or it can be used to produce synthetic liquid hydrocarbons via the Fischer-Tropsch process. Incomplete combustion of methane with air and further “reforming” with steam leads to a mixture of nitrogen and hydrogen, suitable for synthesis to ammonia. Two major uses of the latter are for making nitrogenous fertilizers and for making urea, a constituent of a large group of plastics. Another large volume chemical intermediate that may be produced from natural gas is acetylene. This is a relatively new development. Acetylene is the starting point for a number of synthetic resins, fibers, and rubbers. For example, it may be

*A more detailed description of specific petrochemical processes and a general assessment of their potentialities in Alberta are given in a Research Council of Alberta publication, “The Chemical Utilization of Natural Gas” by Quon, D. and Govier, G. W., Research Council of Alberta Mimeographed Circular No. 12, 1952.

FIGURE 1

CHEMICAL PRODUCTS FROM NATURAL GAS



reacted with hydrogen cyanide (which may be produced from natural gas, ammonia and air) to give acrylonitrile. The latter is the basic building block for such varied end products as synthetic rubber (Buna N type), synthetic fibers (dynel, orlon), plastics, and soil conditioners (Krilium).

2. Processes Using Ethane-Propane

The main chemical use of the ethane-propane fraction is for conversion to ethylene. The latter is the most important single chemical in the whole synthetic organic chemical industry and is produced in larger quantities than any other organic chemical. The reactions of ethylene provide perhaps the most striking example of the versatility and diversity of organic syntheses. Ethylene may be reacted: with oxygen to produce ethylene oxide, and hence to ethylene glycol or ethanolamine; with water to form ethanol, and hence to acetaldehyde; with ethyl benzene to form styrene, a basic rubber monomer; with itself under pressure to produce the new wonder plastic, polyethylene, with hydrogen chloride to give ethyl chloride and hence to tetraethyl lead, a gasoline additive, or to ethyl cellulose, a plastic; with chlorine compounds to form vinyl chloride or vinylidene chloride, basic monomers for a whole class of vinyl plastics.

Propylene, in large quantities, is also formed from the "cracking" of propane. Like ethylene, propylene is a basic chemical building block, given rise to such products as glycerin and nitroglycerin, alkyd and methacrylate resins, acetone and other solvents, aldehydes and alcohols.

3. Processes Using Butane

There are two main petrochemical uses for butane. The first is in the manufacture of synthetic rubber. Butane is "cracked or dehydrogenated in two stages, first to butylene and thence to butadiene. The latter is the most important monomer in the synthetic rubber industry. Butane may also be partially oxidized, under special conditions, to give a wide variety of oxygenated organic compounds — alcohols, ketones, aldehydes, esters, and organic acids.

GENERAL DISCUSSION

The tremendous impact of the chemical industry in general (and of the petrochemical industry in particular) on the economy of this continent and on the living habits of the average citizen is, of course, a familiar story. Much of man's physical needs have been and continue to be supplied by living matter, "organic" matter. He uses vegetable fibers and animal hair for clothing, rubber from trees, drugs from plants, soap from animal fats, wood for building. But within the last several decades, a new factor has entered the picture — a synthetic organic chemical industry — which has freed him, to a large extent, from the patterns imposed by nature. Man now has access to synthetic fibers, synthetic rubber, synthetic drugs, synthetic detergents, and all types and kinds of plastics. This impressive list of chemical substitutes — in fact, more than substitutes since in many cases they have been so clearly superior to the original products that the use patterns have been extended and broadened — will continue to grow, and against this onslaught, more and more natural products must inevitably give way. This new giant synthetic organic chemical industry naturally requires huge quantities of raw materials. At first sight, the raw material needs seem simple — carbon, hydrogen, some oxygen, some nitrogen and perhaps chlorine and sulphur, but essentially carbon and hydrogen.

Since the elements carbon and hydrogen are so seemingly plentiful, what makes petroleum and natural gas hydrocarbons, in particular, such preferred raw materials? The answer is manifold. From the economic point

of view, they are cheap, they are plentiful, they are easy to handle and to transport. From the technological point of view, they have about the right carbon-to-hydrogen ratio; they are reproducible raw materials and are available in substantially pure forms, they are or can be readily converted to simple chemical building blocks, making them extremely versatile chemically. The two large alternate raw material sources for synthetic organic chemicals are coal and vegetable matter. Coal, however, varies considerably in chemical and physical properties, depending on the source, contains impurities not always easily removable, and perhaps most important of all, contains very little hydrogen. True, coal can be converted into hydrocarbons but only at a price. Actually, the future of coal chemicals is probably in aromatics (although even here petroleum has some clear advantages) and, in a very real sense, coal and petroleum hydrocarbons are complementary rather than competitive raw materials. Vegetable matter (of recent origin), like coal, is in a solid form often costly to gather and transport, contains a great deal of oxygen and combined water that is not always welcomed, and is made up of complex molecular units which are not readily convertible to simple chemical intermediates. The growing trend towards petrochemicals is, therefore, likely to continue.

With man's apparently insatiable appetite for synthetic organic chemicals and with the hydrocarbons from the earth — available in immense quantities judged by today's standards but by no means limitless — providing such ideal raw materials, the question must be asked, "How long can man afford to continue burning them?" That question may not have to be answered in this generation, nor perhaps in the next generation but it must be answered sometime, and prudence dictates that a periodic reassessment be made of this priceless resource. One thing does appear certain—long after these hydrocarbons have become too expensive and too precious to be used as fuels, they will continue to form the basis of a vast petrochemical industry.

III. THE AVAILABILITY OF HYDROCARBON RAW MATERIALS

It has been generally accepted that the petrochemical hydrocarbon raw material requirements are small compared to fuel requirements. Table 1 shows the predicted quantities of hydrocarbons available for chemical processing. The values are based on the estimates of gas production and of Canadian crude oil refining capacity, prepared by the Petroleum and Natural Gas Conservation Board and presented in earlier sections:

TABLE 1.
ESTIMATED AVAILABILITY OF HYDROCARBON RAW MATERIALS IN CANADA

	Millions of lbs. annually				
	1955	1960	1965	1970	1975
Natural Gas					
Methane	3,500	19,200	29,500	39,000	44,700
Ethane	380	2,120	3,260	4,300	4,950
Propane	180	620	1,160	1,585	1,820
Butane	80	265	490	675	780
Sulfur*	240	1,330	2,100	2,690	3,110
Refinery Products					
Off-Gases					
Ethane-ethylene	1,010	1,410	1,860	2,230	2,780
Propane-Propylene	2,650	3,720	4,910	5,890	7,330
Butane-butylenes	2,660	3,750	4,950	5,940	7,390
Petroleum Fractions					
Aromatics	3,210	4,500	5,940	7,120	8,860

*Sulfur, although certainly not a hydrocarbon, is included here because it is a by-product of natural gas processing.

The following notes explain the procedure followed in preparing these estimates:

(1) Availabilities of methane and ethane were calculated on a total production basis. The production here is elastic and the only significant point is the relative orders of magnitude of gas required for petrochemical needs and that required for fuel. The natural gas is assumed to contain 8.0 per cent ethane and 85 per cent equivalent methane.

(2) The propane and butane figures represent the estimated actual production from gas-processing plants. The production of these two components is inelastic and tied into total production of natural gas.

(3) Sulfur availability has been calculated on the basis of the average sulfur content of natural gases in existing fields, namely 2.4 million pounds of sulfur per billion cubic feet of gas, without making any allowance for which fields are actually being produced. Not all of this sulfur, of course, is economically recoverable.

(4) The availabilities of C_2 to C_4 hydrocarbons from refinery off-gases were calculated on the basis of gas yields actually experienced by local refineries. The figures used are as follows: per barrel of crude oil refined, 4.7 pounds of ethane-ethylene, 12.4 pounds of propane-propylene, and 12.5 pounds of butane-butylenes are available. Naturally, gas yields are dependent upon both the nature of the refining process and the crude oil but the order of magnitude is believed to be correct.

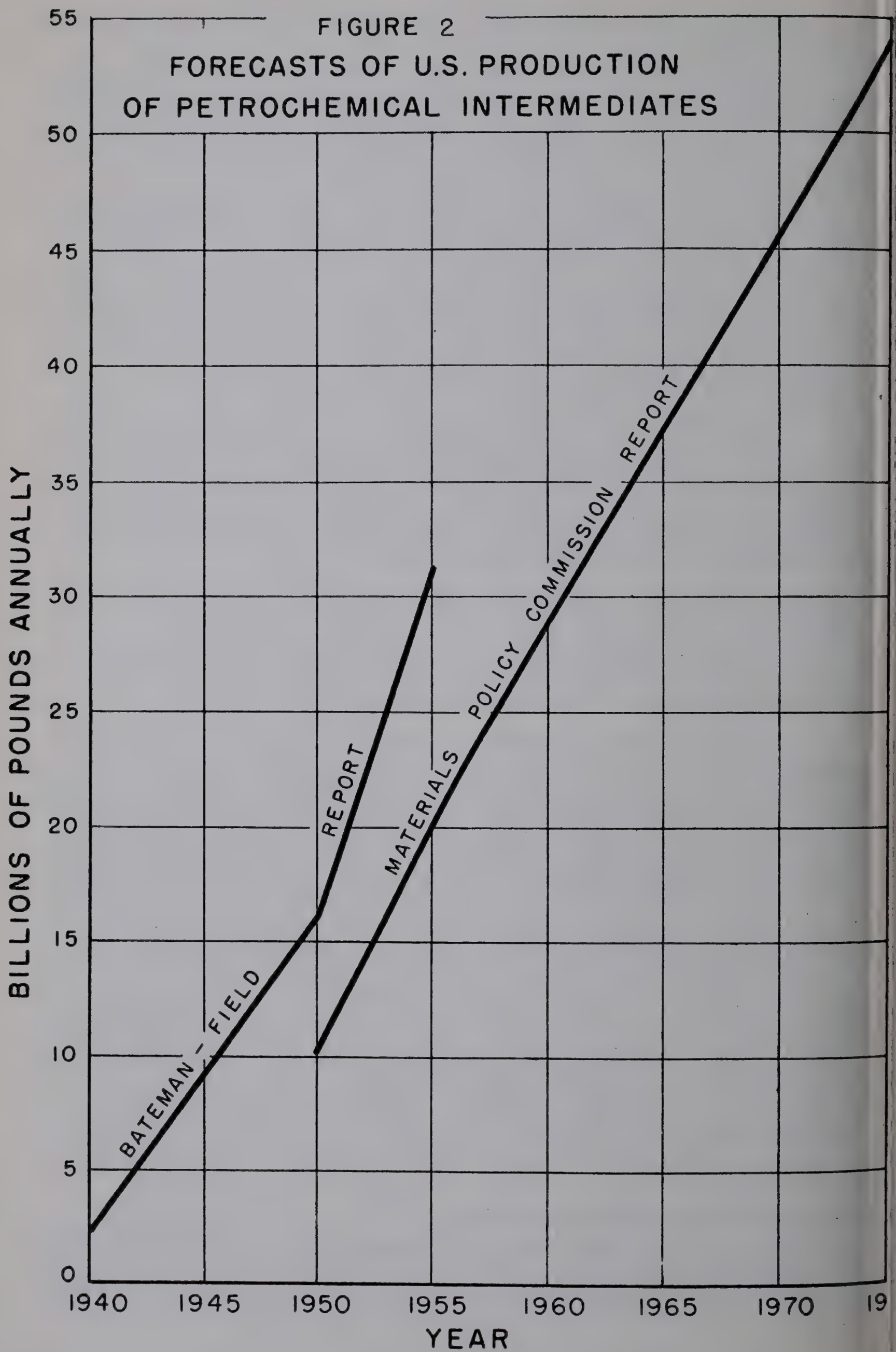
(5) The availability of aromatics from petroleum is based on direct recovery and by platforming. The estimated yields are: per barrel of crude oil, 2.5 pounds of benzene, 5.0 pounds of toluene and 7.5 pounds of C_8 aromatics. These figures have been used in previous American surveys.

IV. PETROCHEMICAL MARKET TRENDS

In predicting future markets for Alberta's blossoming petrochemical industry, several approaches are possible. One could, for example, project the production of existing petrochemical plants in the Province, examine the various petrochemical processes, evaluate the prospects of specific new plants being built in Alberta, and then sum up all the individual estimates to draw the complete picture. While perhaps valid for short-term analysis, this method has serious handicaps. For one thing, the decision on whether or not to locate a particular plant in a specific area depends on local and often unique economic factors that can hardly be appraised except after a most careful and detailed survey. Obviously time does not permit such a procedure. An even more valid objection is that this approach does not take into account the new uses of petrochemicals which are certain to develop. Altogether, it seems more logical to attack the problem from a broader viewpoint — to survey the American petrochemical industry and note its pattern of development, to determine whether or not its Canadian counterpart has or is likely to follow a parallel course, to examine market trends, to assess the decisive economic and technical factors affecting the regional distribution of plant facilities and then, having done all these things, to see if a rational estimate can be made of Alberta's petrochemical prospects.

The American Petrochemical Industry

The magnitude of the growth of the American petrochemical industry can be illustrated by one fact. In 1940, the capital investment was less than \$65,000,000, the word "petrochemical" had hardly been coined; today, the



industry is worth some \$4,000,000,000 with an annual production value of over \$3,000,000,000. In 1953, the petroleum-derived chemicals had accounted for: more than 75 per cent of the butadiene requirements for synthetic rubber, 14 to 19 per cent of all plastics, over 75 per cent of all synthetic detergents, about 50 per cent of all nitrogen for fertilizers and 70 per cent of all ammonia, 13 per cent of all synthetic fibers, and around 30 per cent of all insecticide chemicals. Total petrochemical production in 1955 is estimated to be 31.5 billion pounds, representing about one-quarter of the total American chemical production* in tonnage and over one-half of the total in dollar value.¹

There have been two authoritative surveys of the petrochemical industry. One, by Bateman and Field (of the Carbide and Carbon Chemicals Corp.), gave a recapitulation² of the growth history up to 1952 and also a short-term projection of production to 1955. The other survey³ was a long-term forecast of U.S. petrochemical needs to 1975, prepared by the Standard Oil Development Co. for the President's Materials Policy Commission (1952).

The results of the two studies are presented graphically in Figure 2. There is a marked discrepancy in the data for the overlapping years covered by the two groups of workers, with the S.O.D. figures about one-third lower. Latest statistics show Dr. Bateman's estimates to be substantially correct but the Materials Policy Commission was primarily interested in long-term trends, and in the projected rates of growth there is no basic disagreement.

The Commission's estimates of primary petrochemical requirements (classified according to eight major end uses) in 5-year intervals to 1975 are shown in Table 2.

TABLE 2.
U.S. END - USE PETROCHEMICAL REQUIREMENTS, 1955 - 1975

End Use	1955	Millions of lbs. annually			
		1960	1965	1970	1975
1. Synthetic fibers -----	1,530	1,820	2,100	2,470	2,740
2. Synthetic rubbers -----	2,290	2,600	2,960	3,180	3,510
3. Plastics & Plasticizers ---	4,510	9,450	14,460	19,320	24,670
4. Protective coatings -----	1,180	1,560	1,870	2,230	2,590
5. Automotive chemicals ---	2,180	2,550	2,890	3,150	3,400
6. Nitrogen products -----	2,720	4,210	5,370	6,500	7,670
7. Synthetic detergents -----	660	830	940	1,060	1,100
8. Miscellaneous -----	5,170	6,220	6,880	7,700	8,500
Total primary products	20,240	29,240	37,470	45,610	54,180

Normal growth rates are predicted for most uses but an exceptionally high demand is anticipated for plastics. Truly, the plastics market appears to be almost unlimited. One perhaps justified criticism of these estimates is that they do not take into account any new large outlets for petrochemicals. Judging from past trends, it is hard not to take the view

1 Purcell, R., World Petroleum 26, No. 2, 52 (1955).
2 Bateman, R. L. and Field, J. A., "The Scope and Growth of the Petro-chemical Industry", paper presented before the Division of Petroleum Chemistry, American Chemical Society, Chicago, September 9, 1953.
3 President's Materials Policy Commission, "Resources for Freedom—Volume IV, The Promise of Technology", June, 1952.
* Primary Chemicals only. The current U.S. production value of overall chemicals and allied products is around 22 billion dollars, while the value of primary chemical production is only about 6 billion dollars.

that the overall estimates are conservative. The average predicted growth rates for each 5-year period are as follows:

Period	Growth Rate
1955 - '60	7.8% per year
1960 - '65	5.0% per year
1965 - '70	4.0% per year
1970 - '75	3.5% per year

However, over the past 30 years, the growth rate of the chemical industry as a whole has been 9.8 per cent per year compared to 2.9 per cent per year for overall industrial production and 0.9 per cent per year for population.¹ Furthermore, the petrochemical section of the chemical industry has had an even more remarkable record, showing a growth rate of about 14 per cent per year for the past decade. Evidently the Commission must have felt that the petrochemical industry is rapidly approaching maturity, after which its growth rate will approach that of industry as a whole — a view which is by no means unanimously shared by other authorities.

Of particular interest is the split between the hydrocarbon raw materials supplied by natural gas and that supplied by petroleum refinery products. Natural gas can be used in two ways — either for its methane content or as a source of higher hydrocarbons. The main present use of the latter is for conversion into ethylene. The refinery is a source of higher olefines and paraffins as well as aromatics. The expected raw material distribution, by source, is shown in Table 3.

TABLE 3.
U.S. PETROLEUM AND NATURAL GAS REQUIREMENTS FOR CHEMICALS,
1955 - 1975

	1955	Millions of lbs. annually			
		1960	1965	1970	1975
Natural Gas*					
for methane content	4,830	6,640	8,100	9,680	11,150
for cracking to ethylene....	1,510	2,070	2,500	2,880	3,120
	<u>6,340</u>	<u>8,710</u>	<u>10,600</u>	<u>12,560</u>	<u>14,270</u>
Refinery Products					
for cracking to ethylene....	1,510	2,380	3,230	4,020	4,940
for cracking to propylene	1,640	1,980	2,280	2,580	2,820
butane and butylenes	1,880	2,140	2,450	2,680	3,040
pentenes, pentanes plus	540	650	740	900	1,060
aromatics	3,130	5,450	7,780	10,120	12,650
	<u>8,700</u>	<u>12,600</u>	<u>16,480</u>	<u>20,300</u>	<u>24,510</u>
Total	<u>15,040</u>	<u>21,310</u>	<u>27,080</u>	<u>32,860</u>	<u>38,780</u>

*Does not include natural gas used in making carbon black.

Attention is drawn to the fact that natural gas supplies approximately 40 per cent by weight of all the hydrocarbon raw material needs of the petrochemical industry, with the methane content being responsible for three-quarters of this total. As a result of rising gas prices, a small trend

¹ Chemical Economics Handbook, Stanford Research Institute, Palo Alto, California (1955).

is anticipated towards petroleum and away from natural gas as a primary raw material but the overall picture is not altered significantly.

Geographically, the heart of the American petrochemical industry is in the Gulf Coast area which accounts for an estimated 75 per cent of the total petrochemical production. This remarkable concentration of an industry in one region is due to a number of factors, among which are: availability of raw materials, cheap fuel, excellent climate for year-round plant operation, practicability of large scale integrated operations, and access to cheap water transportation to markets.

The Canadian Outlook

Like the American petrochemical industry, the Canadian counterpart has shown a very remarkable growth. The eastern portion, based on refinery petroleum products, had its start during the war and has continued to expand in the post-war era; the western portion (in Alberta), based on natural gas, has developed largely in the past five years. Production figures are not readily available since the Dominion Bureau of Statistics classifies chemicals by end-use rather than by the source of the raw material. However, a reliable guide to the magnitude and importance of the petrochemical industry is given by the value of the plant investments. A list of the major petrochemical plants in Canada is shown in Table 4¹ together with the location, the nature and volume of products and, wherever possible, the estimated investment.

¹ Editor, *Petroleum Processing*, 10, No. 9, 1413 (1955).

TABLE 4.
PETROCHEMICAL PLANTS IN CANADA, 1955

ALBERTA*

Company	Location	Approximate Investment	Raw Materials	Products and Output	Remarks
Canadian Chemical Co.	Edmonton, Alta.	\$65,000,000	Natural gas (Propane and butane)	Cellulose acetate, solvents, pentaerythritol, alcohols, aldehydes, esters, glycol, ketones	Canadian affiliate of Celanese Corporation of America.
Canadian Industries Ltd.	Edmonton, Alta.	\$16,000,000	Ethane from natural gas	Polythene—16,000,000 lb./yr.	
Consolidated Mining & Smelting Co.	Calgary, Alta.	\$10,000,000	Natural gas	Ammonia—130,000 tons/yr.	
Inland Chemicals Co.	Ft. Saskatchewan, Alta.	\$ 1,000,000	Sulfur	Sulfuric Acid 36,500 tons/yr.	Scheduled for completion in 1955.
Northwest Nitrochemicals Ltd.	Medicine Hat, Alta.	\$18,000,000	Natural gas	Nitrogenous fertilizer	Scheduled for completion in 1956.
Royalite Oil Co.	Turner Valley, Alta.		Natural gas	Sulfur—14,000 tons/yr.	
Shell Oil Co.	Jumping Pound, Alta.	\$ 1,000,000	Natural gas	Sulfur—28,800 tons/yr.	
Sherritt-Gordon Co.	Ft. Saskatchewan, Alta.	\$24,000,000	Natural gas	Ammonia—27,000 tons/yr. Ammonia sulfate—72,000 tons/yr.	Ammonia is used in refining nickel concentrates from Lynn Lake, Manitoba.

* By definition, this list does not include perhaps 35 to 45 million dollars worth of natural gas-processing plants, and some 65 million dollars worth of refineries, with a capacity of about 70,000 barrels per day. A complete list of these processing plants and refineries, showing location and capacities, has been included in an earlier section, prepared by the Petroleum and Natural Gas Conservation Board.

TABLE 4 (Continued)
 PETROCHEMICAL PLANTS IN CANADA, 1955

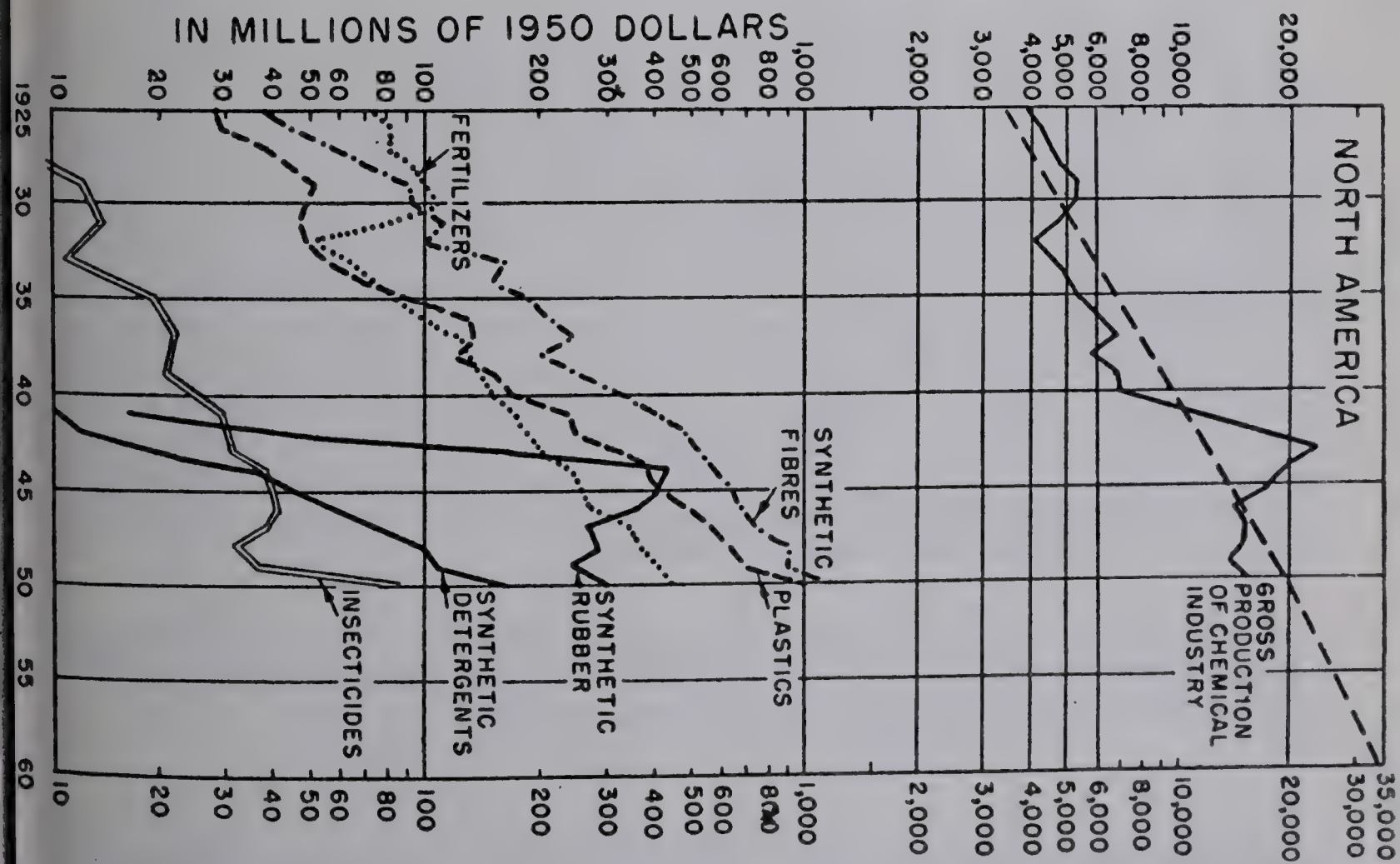
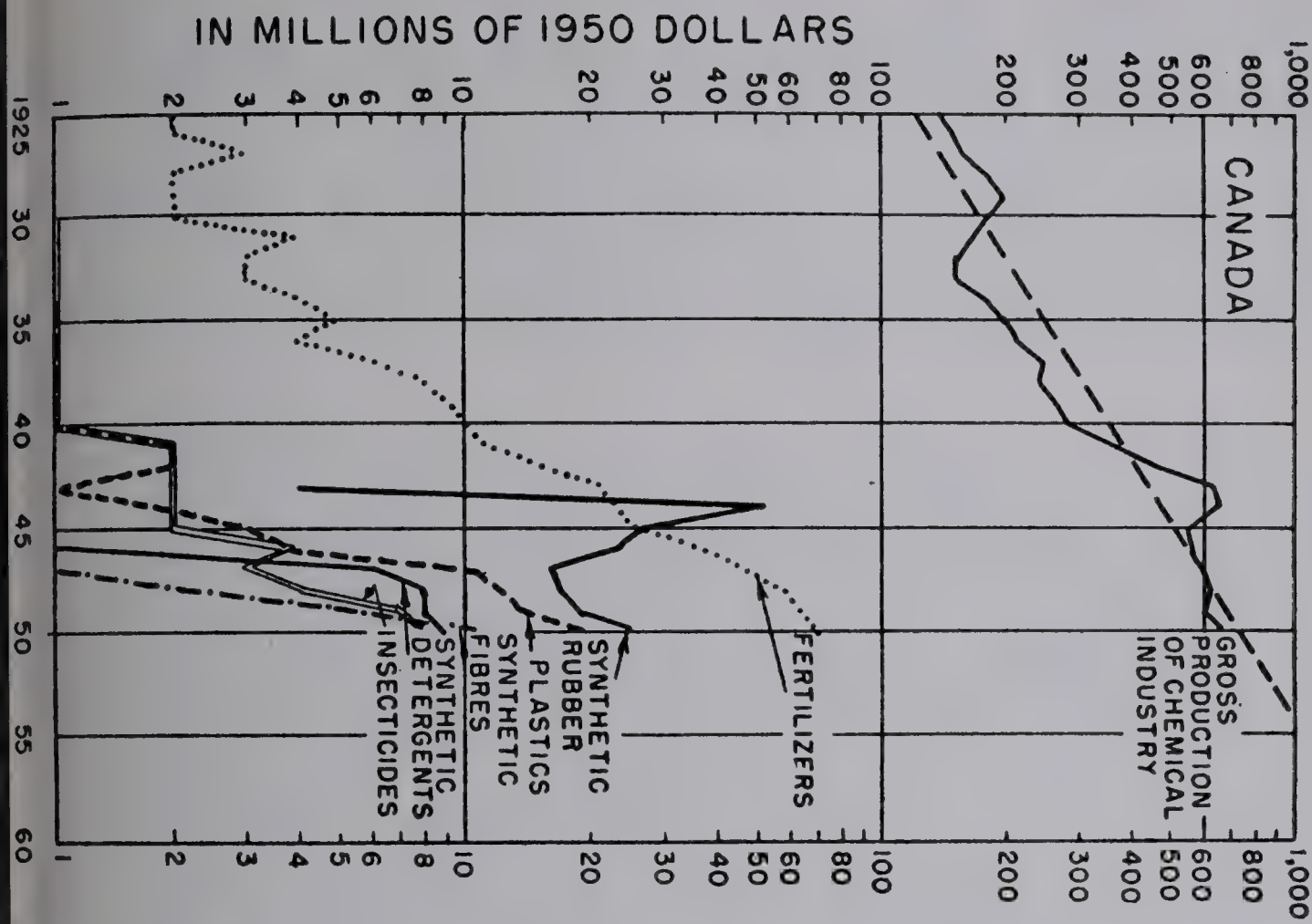
SARNIA

Company	Location	Approximate Investment	Raw Materials	Products and Output	Remarks
Cabot Carbon Co.	Sarnia, Ontario	\$ 3,500,000	Petroleum fractions	Gross value—\$2,500,000 in 1954. Furnace blacks—40,000,000 lb./yr.	
Dow Chemical Co.	Sarnia, Ontario	\$35,000,000	Refinery gases	Gross value—\$25,000,000 in 1954. Ethylene, ethylene oxide, ethylene glycol, styrene, carbontetrachloride, ammonia, trichloroethylene, polystyrene and others.	
Ethyl Corp.	Sarnia, Ontario	\$14,000,000	Ethane and ethylene	Anti-knock fluids	Scheduled for completion in 1956.
Polymer Corp. Ltd.	Sarnia, Ontario	\$70,000,000	Refinery gases	Gross value—\$53,000,000 in 1954. Styrene, monomer, ethylene, isobutylene, butyl rubber—85,000 tons/yr.	
Sun Oil Co.	Sarnia, Ontario		Refinery gases	Butylenes	

TABLE 4 (Continued)
PETROCHEMICAL PLANTS IN CANADA, 1955

OTHER					
Company	Location	Approximate Investment	Raw Materials	Products and Output	Remarks
B.A. Shawinigan	Montreal, Quebec	\$ 4,000,000	Cumene	Est. 1955—\$2,500,000 Phenol—13,000,000 lb./yr. Acetone—8,000,000 lb./yr. methyl styrene— 24,000,000 lb./yr.	
B.A. Oil Co.	Montreal, Quebec		Refinery gases	Cumene—4,000,000 lb./yr.	Supplies material for above plant.
Canadian Industries Ltd.	Millhaven, Ont.	\$20,000,000	Refinery gases, ethylene glycol, dimethyl terephthalate	Ammonia—73,000 ton/yr. Terylene—11,000,000 lb./yr.	
Carbide Chemicals Co.	Montreal East		Refinery gases	Ethylene glycol, Polyethylene	
Dupont Co.	Maitland, Ont.		Cyclohexane	Hexamethylene diamine Adipic acid	Nylon intermediates
Lubrizol of Canada Ltd.	Niagara Falls, Ontario		Petroleum fraction	Lube oil additives	
Monsanto Canada Ltd.	Montreal, Quebec		Petroleum base stock	Polystyrene	
S. Nord Chemical Co.	Petrolia, Ont.	\$ 1,500,000	Catalytic reformate	Benzene, toluene, xylenes 30,000,000 gal./yr.	Scheduled for completion in 1956.
Quebec Ammonia	Near Montreal, Quebec	\$ 8,500,000	Fuel oil	Ammonia—43,800 tons/yr.	In building stage.
St. Maurice Chemical Co.	Varenes, Que.		Methanol, Acetaldehyde	Formaldehyde Pentaerythritol	

FIGURE 3
CANADIAN AND NORTH AMERICAN
CHEMICAL PRODUCTION



For its size, the petrochemical industry in Canada is quite diversified and all the major end uses of petrochemicals—synthetic fibers, synthetic rubbers, plastics, protective coatings, automotive chemicals, fertilizers—are represented. It is estimated that the present value of the Canadian petrochemical industry is around \$300,000,000. Of this total, about \$120,000,000 is invested in Alberta, roughly the same amount around Sarnia, Ontario and the rest of it in Eastern Canada with a fairly large concentration in Montreal East. The industry has clearly developed beyond the infancy stage and might now be expected to follow a more normal growth pattern. However, it might well be wise to consider the Canadian chemical picture as a whole before attempting to predict the growth of one particular segment of it.

In general, how does the chemical development in Canada compare with that of the United States? The overall chemical growth histories for the two countries for the past 30 years are given in Figure 3.¹ Also included are the production curves for a few selected end-users of petrochemicals. Since the population of the United States is 10 to 12 times that of Canada, superimposition of the two sets of curves would give almost a direct per capita basis of comparison. Doing this, it is noted that the total Canadian per capita production of chemicals is one-half to two-thirds that of the American, reflecting the different degree of maturity of the two economies. To express it in another way, there is a 5 to 10 year lag in the Canadian development. This generalization is also valid for most individual petrochemical end usages, being quite evident in the case of synthetic fibers and plastics and, to a lesser degree, in the case of synthetic rubber, fertilizer, synthetic detergents, and insecticides. The really significant point though is that the rates of growth of the chemical industries in the two countries are almost identical and that the production patterns are basically similar.

No evaluation of Canadian markets is complete without taking into account the effect of external trade. Generally speaking, chemical industries in all countries having industrial pretensions are protected and nurtured—a direct consequence of the twentieth century's unmistakable trend towards national economic self-sufficiency. It is true that Canada does not offer her chemical industry the same degree of tariff protection as do most industrialized nations, but it is still probably fair to say that for chemicals that are produced in this country, tariffs are moderately high. This is reflected in the production and import and export curves¹ presented in Figure 4. In recent years, the net balance between imports and exports has not formed an appreciable fraction of the total production. As an indication of the growing strength of the chemical industry, for the past decade exports have exceeded imports. It seems likely, therefore, that as Canada's chemical consumption increases, that increase will be met, to a very large degree, by the expansion of her own chemical industry.

However, some individual chemical industries may be affected to a greater extent by trade considerations. The past trade record² of five major end-users of petrochemicals is given in Table 5.

1 "The Chemical Industry in Canada", Economics Branch, Department of Trade and Commerce, Ottawa (1954).

2 Ibid.

FIGURE 4
CANADIAN PRODUCTION, IMPORTS,
AND EXPORTS OF CHEMICALS
1920 - 1952

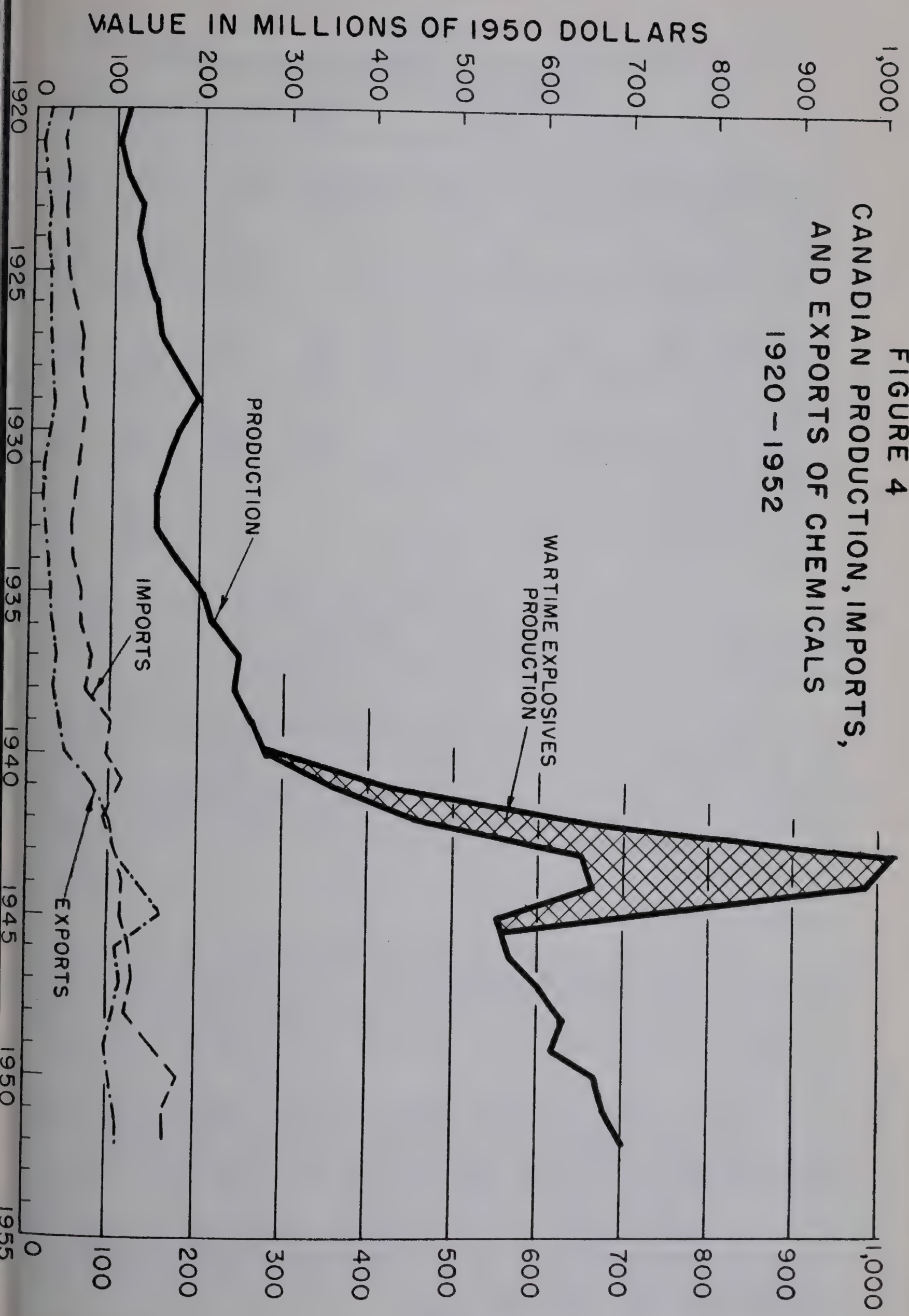


TABLE 5.
CANADIAN PRODUCTION AND CONSUMPTION OF SELECTED
PETROCHEMICAL END USES

Year	1940	1945	1950	1952
Synthetic Fibers				
Production, millions of pounds	13.4	23.6	60.4	72.5
Consumption, millions of pounds	16.0	40.8	72.5	90.3
Ratio, Production/Consumption	0.84	0.58	0.83	0.80
Synthetic Rubber				
Production, thousands of short tons		51.2	65.0	88.4
Consumption, thousands of short tons		40.3	25.3	39.2
Ratio, Production/Consumption		1.27	2.57	2.25
Synthetic Resins and Plastics				
Production, value in millions of dollars	2.0	6.8	19.1	19.1
Consumption, value in millions of dollars	3.7	14.5	30.4	21.1
Ratio, Production/Consumption	0.54	0.47	0.63	0.91
Fertilizer Materials				
Production, thousands of short tons	525	830	1,077	1,113
Consumption, thousands of short tons	347	575	765	769
Ratio, Production/Consumption	1.51	1.45	1.41	1.45
Synthetic Detergents				
Production, millions of pounds		3	52	87
Consumption, millions of pounds		?	71	98
Ratio, Production/Consumption			0.73	0.89

This indicates that the manufacture of products such as synthetic fibers, plastics and detergents, should expand in a normal fashion but that the growth rate of such products as synthetic rubber and fertilizer will be more uncertain due to their greater reliance on export markets.

Because of the parallel nature of the Canadian and American economies and because as far as chemicals are concerned Canada can be treated as an economic unit, it seems reasonable to take the forecasts of the Materials Policy Commission as a proper guide and basis for estimating future Canadian petrochemical growth, making what allowances may be necessary for the special features of the Canadian picture. There are **plus** factors which would tend to raise the estimates and **minus** factors tending to lower them.

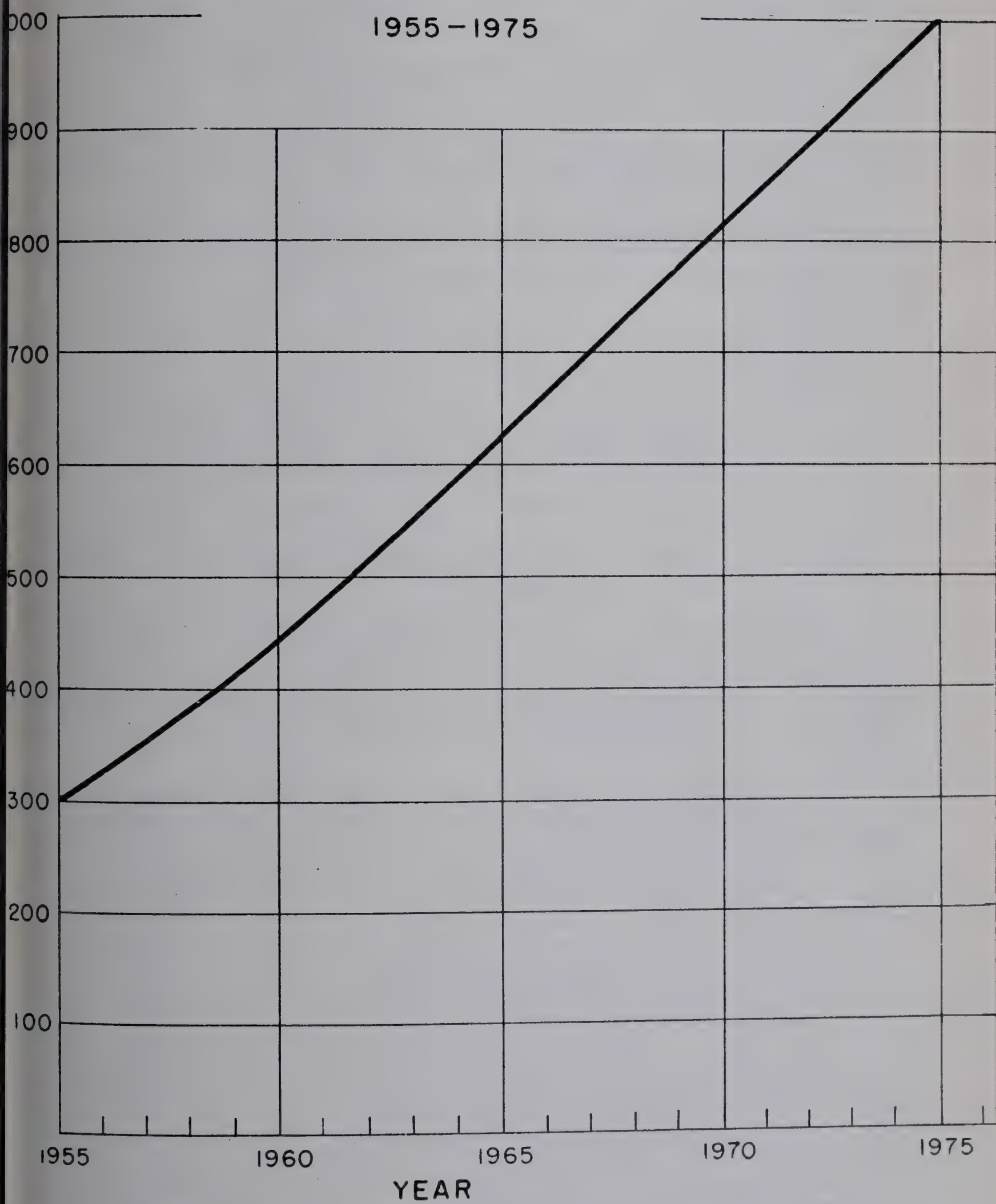
Plus Factors:

1. Because of the time lag of the Canadian economy as compared to that of the American, the chemical industry is on the earlier and steeper part of the growth curve. In other words, the rate of growth of the Canadian chemical industry will tend to remain at a high level even after that of its American counterpart begins to level off as the industry approaches maturity.

2. Because of the tremendous reserves of hydrocarbon raw materials, even with a very large expansion of the petrochemical industry, there will be no appreciable pressure on material resources. In the period under consideration, Alberta will likely continue to be the source of the cheapest hydrocarbon raw materials on this continent.

3. Canada's prospects for large population growth rates are probably better than those of the United States. For the past 30 years, the American population has been increasing at an average annual rate of 0.9 per cent, that of Canada's at 1.7 per cent.

FIGURE 5
FORECAST OF CANADIAN
PETROCHEMICAL INVESTMENTS



Minus Factors:

1. The small size of the domestic market as compared to that of the American tends to lead to uneven and sporadic growth.
2. From the view point of Canada as a whole (but certainly not from Alberta's!), the petroleum and natural gas reserves could be more advantageously located. These are in Alberta, a sparsely populated area hundreds of miles and "rail miles" removed from Eastern markets. This means that the Canadian petrochemical industry, as a whole, is not in as strong a position as its American counterpart in meeting competition from alternative chemical processes.

Taking all these factors into consideration, it was judged advisable to apply the Commission's projected rates to the Canadian petrochemical industry but to allow a 5 year time lag. In other words, a growth rate of 7.8 per cent is assumed for the first two 5 year periods up to 1965, a rate of 5.0 per cent from 1965 to 1970 and a rate of 4.0 per cent from 1970 to 1975. In making these projections, a number of major assumptions have been implied:

- (1) No major war
- (2) No prolonged depression
- (3) No unforeseen technological developments which would:
 - (a) Change the character of the automotive fuel requirements and hence the nature of the refining process, or
 - (b) change the character of the energy requirements of the country, or
 - (c) require tremendous quantities of petrochemicals in uses not presently known.

The end results are presented in Figure 5. It would, of course, have been more prudent to show a broad band instead of a line for the growth curve. However, the width of the band is an unknown quantity and it is realized that at any time the error may be 10% or more, even in the early years. If a further judgment has to be made, the intuitive feeling is that the estimates are conservative.

The analysis predicts a billion dollar Canadian petrochemical industry by 1975. Production is, of course, intimately connected with capital investment and in the chemical industry one commonly used yard-stick is that for every dollar invested, the annual production should be roughly the same, or perhaps somewhat less. It is recommended that the value of annual production may be estimated by multiplying the total investment by 0.80.

The raw material needs of this expanded petrochemical industry must now be considered. It is axiomatic, of course, that the petrochemical requirements for raw hydrocarbons are small compared to the overall fuel requirements. Even a billion dollar industry, forecast for 1975, will require only about 6,200 million pounds of hydrocarbons annually as raw material. Assuming the predicted American use pattern to be valid, this total might consist of about 1,300 million pounds of high methane gas, about 3,000 million pounds of petroleum fractions, and some 1,900 million pounds of C_2 to C_4 fractions, the latter to be derived from either natural gas or refinery off-gases. A comparison of these values with the hydrocarbon availability figures presented in Table 1 indicate that there is little likelihood of shortage within the forecast period. If a reasonable split is made between the higher

paraffins derived from natural gas and from refinery off-gases, then on an overall basis, the petrochemical industry, by 1975, would consume only about 3.5 per cent of all the natural gas produced and about 2.5 per cent of all the crude oil refined in Canada. It may be justifiably concluded, therefore, that as far as the development of a Canadian petrochemical industry is concerned, availability of raw materials will not be a limiting factor.

V. ALBERTA'S PETROCHEMICAL FUTURE

At the present time, petrochemical plant investment in Alberta is around \$120,000,000, as compared to the Canadian total of \$300,000,000. Thus, Alberta possesses about 40 per cent of Canada's petrochemical industry. In the previous section, a forecast was made of future Canadian petrochemical growth. The main unresolved question then is the extent to which Alberta will participate in that growth.

Of course, no hard and fast answers are possible but the following points should be kept in mind:

(a) Alberta's petrochemical industry is based mainly on natural gas; that of Eastern Canada's on refinery products. The importance of the methane fraction of natural gas as a raw material is indicated by the Materials Policy Commission figures (Table 3) which show that methane is expected to supply 30 per cent of the tonnage raw material for the petrochemical industry. Up to now, all Canadian industries based on methane had to locate in Alberta. Alternative sites will, however, become available as a Canadian gas pipeline system is built. The question then becomes — is it more economic to build a plant in Alberta, based on both cheap raw material and cheap fuel, or along or at the end of a pipeline where hydrocarbon costs are considerably higher but where product transportation costs are lower? The answer probably lies in the price of the end product (or perhaps more accurately in the amount of hydrocarbon required per unit of product). For high priced end products like plastics, resins, synthetic fibers (selling for 30 cents a pound or more), Alberta would still be the favoured location. On the other hand, for low priced end products like nitrogenous fertilizers, selling for around 5 cents a pound and having comparatively low hydrocarbon requirements (by weight) per unit of product, the plants will likely be built near the markets. The announced plans for building an ammonia plant in Winnipeg, Manitoba, using pipeline gas, is in accordance with this analysis. However, an examination of the projected use patterns of methane-derived chemical products in the Commission report suggests that, on the basis indicated above, Alberta should capture a very substantial portion of that part of the petrochemical industry based on methane.

(b) Some 25 to 30 per cent of present and projected petrochemical requirements are for aromatics derived from crude refining operations. The large refineries in Eastern Canada (Sarnia, Montreal East), located close to markets, appear to be the best raw material sources. Since the transportation of crude oil is relatively cheap, it is likely that this portion of the petrochemical industry will remain in the East.

(c) Some 40 to 45 per cent of the industry is based on C_2 to C_4 hydrocarbons, available either from natural gas or from refinery off-gases. However, not all the petrochemical processes in this category are mobile. Probably a substantial portion of them are integrated with petrochemical processes considered under either (a) or (b).

Although there may be significant cross-trends, the pattern of Canadian petrochemical growth is expected to follow these general lines—

those processes, making high-value end products, and based on methane, will find Alberta economically attractive; those processes, based on aromatics, will likely build in the East; the location of those processes, having a choice of hydrocarbon raw materials, will be individually dependent upon the prevailing economic climate.

The following plus and minus factors are pertinent to Alberta's position:

Plus Factors:

(1) Alberta's petrochemical industry is of very recent origin and the existing plant distribution may not be truly representative. Actually since 1950, considerably more than 40 per cent of the new Canadian petrochemical investment has been in Alberta.

(2) Alberta has competed quite successfully for those petrochemical plants using the higher paraffin hydrocarbons, components which could be obtained either in Eastern Canada or in Alberta — thus indicating that the western province's distance from markets is not necessarily an insuperable handicap. Canadian Chemical Co.'s cellulose acetate and organic chemical plant and Canadian Industries Limited's polyethylene plant are, of course, the two cases in mind. The only existing large scale use of methane in Alberta is for ammonia production, but it seems certain that as both the plastics and the synthetic fibers industries continue to develop, they will look towards Alberta. In the American pattern, both are very large users of methane but the Canadian per capita production of these two products shows a pronounced time lag.

(3) As natural gas is exported in large volumes from Alberta, large quantities of propane and butane will become available. With a vigorous marketing campaign, much if not all of the propane can possibly be sold. However, since the anticipated supply of butane will probably exceed demand, it is expected that the price may be forced down to almost "distress" levels. Prices of 3 or 4 cents per gallon have been suggested. At these prices, butane is a remarkably cheap liquid hydrocarbon. For example, on a carbon basis, the cost would be only about half that for raw unprocessed crude oil; at 4 cents per gallon butane would correspond to 26 cents per MCF natural gas. This would appear then to be a very attractive lure for prospective petrochemical operations. However, a word of caution may be in order. It is doubtful if, in the long run, a manufacturer could count on "distress level" prices — nothing is more certain to raise prices than the appearance of prospective customers.

Minus Factors:

(1) Long distances from major markets.

(2) Relatively high cost plant operation due to severe climatic conditions and also to the lack of large industrial suppliers.

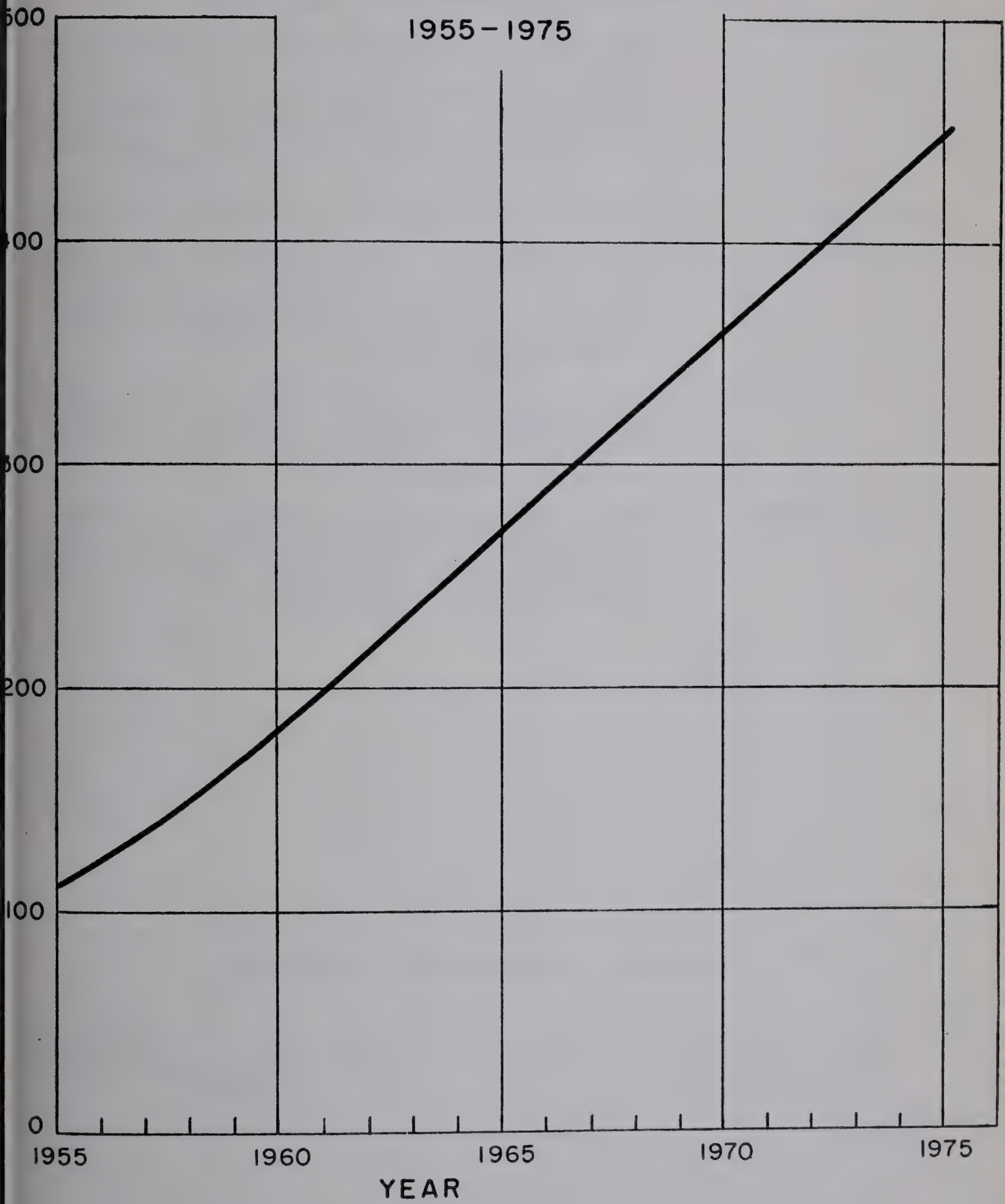
Weighing these factors, it is likely that Alberta's share of Canada's petrochemical industry will increase beyond the present value of 40 per cent, but not too much, due to the limitations imposed by the general pattern. It is suggested that 45 per cent might be a reasonable long time estimate.

A projection of Alberta's petrochemical growth is shown in Figure 6. A capital investment of some \$450,000,000 is forecast for 1975, with a gross annual production around \$360,000,000.

There are good reasons for being optimistic about Alberta's petrochemical future.

FIGURE 6

FORECAST OF ALBERTA'S
PETROCHEMICAL INVESTMENTS



Glossary of Chemical Terms

aromatics	a class of hydrocarbon compounds, having closed ring-like molecular structures (6-member unsaturated rings), characterized by a comparatively higher carbon-to-hydrogen ratio, and usually having a fairly high molecular weight. Examples are benzene and toluene.
cracking	a process for exposing hydrocarbons to the action of heat, or catalysts, or both. Depending upon the severity of the "cracking", the original hydrocarbon may be decomposed to hydrocarbons of lower molecular weight, or may simply lose hydrogen and become unsaturated hydrocarbons. An example of the latter is the cracking of ethane to ethylene.
hydrocarbon	an organic compound consisting only of hydrogen and carbon.
monomer	a single molecule, or a substance consisting of single molecules. Monomers may, under certain conditions, react with each other or with other monomers to form polymers or associated molecules. Some very high molecular weight compounds may be built up this way.
paraffin hydrocarbons	members of a family of saturated hydrocarbon compounds having the general formula C_nH_{2n+2} . The first four members—methane, ethane, propane, and butane—from the hydrocarbon content of natural gas.
refinery off-gases	by-product gases formed from the refining of crude petroleum, containing both saturated and unsaturated hydrocarbons. These include methane, ethane, propane, and butane, as well as ethylene, propylene, and butylene.

ALBERTA'S ECONOMIC PROSPECTS

THE TOURIST INDUSTRY

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December, 1955.

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Tourist Industry

SUMMARY

The analysis of tourist statistics indicates that 300,694 counted visitors in 1945 spent an estimated \$3,661,452 and that the volume and value of tourist business had grown very rapidly so that, in 1954, a total of 1,602,982 counted visitors spent an estimated \$42,021,387 in Alberta and, further that, under prevailing conditions of peace, during the next twenty-five years the volume may reach 4,750,000 visitors with an estimated gross business value of \$200,000,000.

To reach this objective, it is assumed that an orderly development of attractions, highways, accommodation, promotional effort and high standards of service will be encouraged by forethought and aggressive planning in accordance with sound economic and business principles.

Assuming that such policies are pursued faithfully, it is confidently expected that the present Canadian deficit on travel account with the United States which amounted to about \$32.5 millions in 1954 will be eliminated and a favourable position established.

Achievement of the desired volume and value of tourist traffic in Alberta will require:

1. Extension and paving of all highways in national parks in the Canadian Rockies;
2. Recognition by the Canadian Travel Bureau that travel by Canadians in Canada is as important to the Canadian economy as travel by foreign tourists to Canada and, further a continuing and intensive campaign should be conducted to encourage inter-provincial travel;
3. Greater co-ordination of effort between federal and provincial travel bureaus, transportation and private agencies in planning and conducting advertising and publicity campaigns;
4. Expansion and improvement of accommodation and catering services, and greater encouragement by governments to accommodation and restaurant operators in training personnel to higher standards of courtesy and efficiency.
5. Expansion of cultivated activities and entertainment including restoration of historical sites and establishment of museums.
6. Public and private recognition of the fact that Canada's tourist industry can be developed to tremendous value and provide steady gainful employment to large numbers of Canadians without depleting any of Canada's natural resources.

INTRODUCTION

Alberta's priceless heritage of the Canadian Rockies, the foothills, forests and prairies, thousands of lakes and tens of thousands of miles of rivers and streams is neither eternal nor limitless as the foundation for a tourist industry. It is threatened by every new commercial enterprise which seeks power sites, timber berths or minerals; by every visitor who may be careless with fire, and by every hunter who turns "sport" into butchery.

Therefore the future of Alberta's tourist industry "production plant" or "factory" depends materially upon federal government policies respecting protection and conservation because they determine the extent and quality

of those measures which will maintain or destroy this heritage which lies, principally, within national park regions. The following appraisal of Alberta's tourist industry as a factor in the economic development of this province is predicated upon the assumption that measures of protection and conservation presently in effect will continue and that, as in the past, both public and private interests will pursue policies of aggressive development commensurate with sound business and economic practices.

Reference to the charts, table and text following will reveal that the volume of tourist traffic to Alberta has increased in direct ratio to the completion of paved trunk highways. Assuming that all main highways from east to west, including the vitally important Trans-Canada Highway, and at least one highway system from south to north will be completely paved to modern standards by 1960, it will be apparent that, other things being equal, the volume and value of Alberta's tourist traffic should increase at a rate somewhat better than the average for the past ten years and that, thereafter, it may level off somewhat but continue to increase in direct ratio to the capacity of accommodation, the development of resort areas and the promotion of tourist attractions on a year-round rather than on a seasonal basis.

With the exception of about fifty miles of highway east of Jasper, all approach highways through Alberta to the national parks have already been paved. Therefore the speed with which the highway construction, extension and improvement potential is reached depends almost wholly upon the completion of paved year-round highway systems in the national parks under federal authority. Likewise, the expansion of accommodation, catering and servicing facilities which will set the pace for future tourist traffic growth will depend upon the extent to which federal authorities may make accommodation sites and other concessions available and the degree of encouragement they give to prospective accommodation proprietors and operators of tourist attractions.

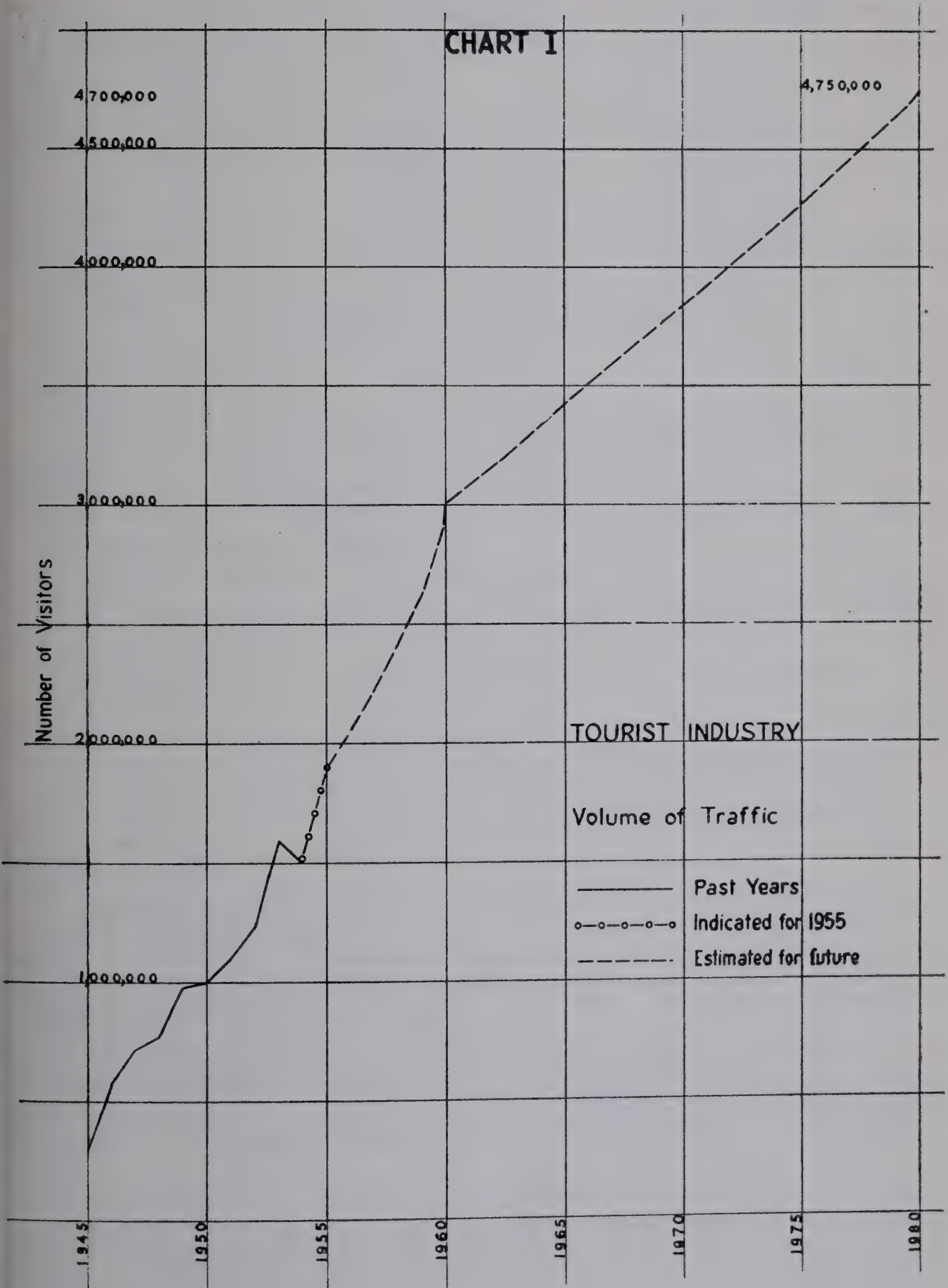
The charts shown in the pages that follow indicate that the volume of visitors may increase to about 4,750,000 and that the value of the industry to the economy of the province may increase to about \$200,000,000.00 by about 1980. Such an estimate for Alberta is not at all unreasonable because it is considerably less than half the value of tourist traffic to some individual States south of the border. Pennsylvania, alone, boasts a tourist traffic valued at about \$400,000,000.00 per year.

When the actual count of persons for the periods mentioned is compared with the estimated value of the traffic in Alberta, it will be seen that the value is based upon the very modest expenditure of about \$26.00 per person during an entire vacation. The lower expenditure per person for local traffic has been taken into consideration. D.B.S. statistics indicate that railway passengers spend an average of about \$140.00 per person and that non-resident motorists spent about \$36.00 per person in 1954. These sums may seem to be much on the conservative side rather than otherwise, especially when it is understood that D.B.S. records indicate that the average length of stay in Alberta for motorists was 7.6 days during the 1954 season.

It will be noted that, while there was a decrease in the volume of tourist traffic in 1954, there was an increase in expenditures. The condition prevailed throughout Canada as a whole.

The notations on the chart indicating the trend for 1955 is based upon available statistics on September 30.

CHART I



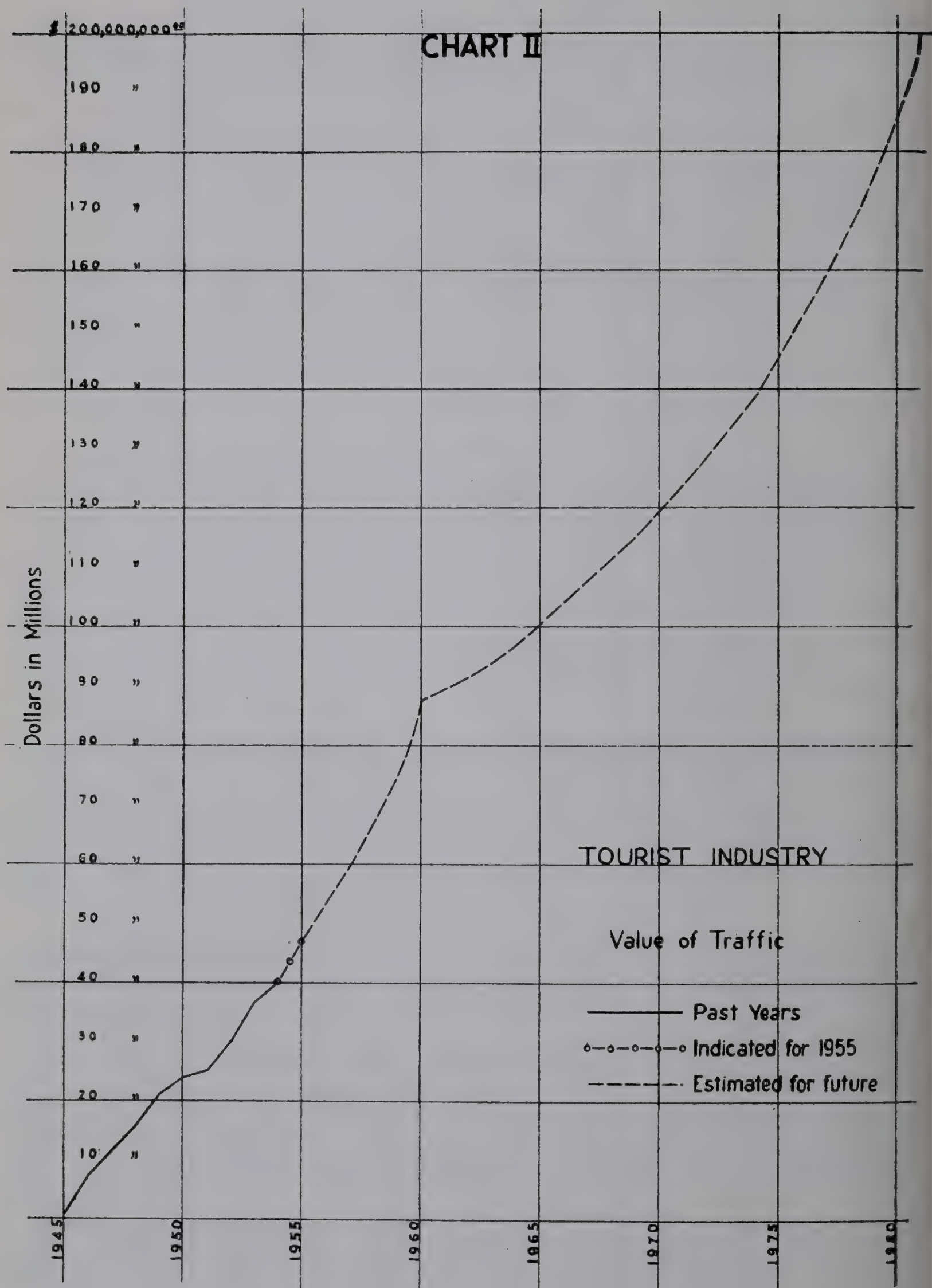


TABLE I.

Year	Visitors entering at customs ports in Alberta and visitors to National Parks April 1 - Oct. 31	Estimated Expenditures
1945	300,694	\$ 3,661,452
1946	575,815	8,571,760
1947	726,531	13,583,020
1948	775,679	17,374,110
1949	998,690	23,200,567
1950	1,084,879	25,981,488
1951	1,112,517	27,100,153
1952	1,289,150	32,033,545
1953	1,643,746	38,866,305
1954	1,602,982	42,021,387

NOTE: See appendix for explanation of sources of statistics used in the compilation of the charts and table.

GENERAL

The orderly development and expansion of Alberta's tourist industry during the next twenty or thirty years will depend upon a progressively ambitious but economically sound improvement of:

1. **Attractions**, the principal of which are located in national parks under federal jurisdiction.
2. **Their accessibility** involving highways through federal terrain.
3. **Accommodation** in national parks administered by the federal government.
4. **Promotional advertising and publicity** involving expenditure of federal, provincial and private funds.
5. **Servicing tourists** which requires highly co-ordinated effort by federal and provincial governments, transportation companies, Chambers of Commerce, Hotel, Motel and Restaurant Associations, oil companies, retail merchants and all other business enterprises.

1. ATTRACTIONS

Alberta's principal tourist attractions are presently afforded by the Canadian Rockies in federally administered national parks which provide natural opportunities for a complete change of environment for large numbers of tourists and for numerous vacation activities including sightseeing, fishing, hiking, climbing, camping, and nature study. They also afford opportunities for the development of cultivated activities such as riding, sports events, and numerous classifications of cultural activities including art, music, drama, etc. Conservation of wild life together with development of attractions, roads and accommodation within national parks is a federal responsibility. Promotion of them is a responsibility of all who benefit therefrom.

In addition to the natural and cultivated attractions of the mountainous regions, Alberta's attractions include historic sites, museums, provincial parks including the bad lands of the Red Deer River Valley together with the Calgary Stampede, the Edmonton Exhibition, numerous district rodeos and other sports events.

A tourist attraction increases in value in direct ratio to its power to retain visitors for a longer stay. By comparison, the Banff School of Fine

Arts which attracts about 600 students and holds them for six to eight weeks is much more valuable, aside from its cultural aspects, than the Banff Indian Days, another very valuable event, which may attract and hold 5,000 visitors for four days. A promoted trail ride which presently attracts and holds 100 tourists for ten days should require no more horses and equipment if nine additional ten-day rides were promoted during the remaining 90 days of the summer season. In this particular instance, if the demand were created, this enterprise might be expanded to nine times its present volume and value within two or three years. Furthermore similar enterprises might be organized in Jasper and Waterton.

It is essential that these and numerous other opportunities be kept in mind when considering possible future trends in Alberta's tourist industry.

Cultivated attractions are virtually non-existent in Waterton Lakes and Jasper National Parks, yet these hold for the future lucrative opportunities including all that is desired in atmosphere and background for the development of local drama, to cite only one example of a cultivated attraction. In some localities in the United States, and especially in North Carolina which may provide a pattern for Alberta's future in this respect, the drama has been developed as a major attraction. Professional directors and leading actors are engaged for the season. Minor parts are played by students or local people interested in the drama.

In each place, a special play has been written to tell the story of some historic event. The plays are presented nightly and employ, in addition to the casts, musicians—who are also music students—stage hands, property men and others.

They provide many students with summer employment which enables them to continue university training.

They have proven sufficiently lucrative in most cases to liquidate the capital expenditure on theatres or out-door amphitheatres, and they not only attract but hold tourists from all parts of the continent.

Waterton Lakes is splendidly adapted to such an enterprise with a play built, probably, around some historic character like Kootenai Brown. A similar project would certainly add considerably to the magnetic power of Jasper if the play were written around the adventurers of the early fur brigades or the "Overlanders" who traversed the Yellowhead Pass en route to the Cariboo district in the early 60's.

Such cultivated attractions should be promoted and aided by adequate federal grants for initial capital expenditures including theatres and amphitheatres but provincial drama groups should be consulted regarding buildings and should organize the production and presentation of plays.

Here again future trends in Alberta's travel industry depend very much upon the degree of vision, foresight and husbandry of federal authorities.

The future economic value of attractions will increase in direct ratio to the extension of Alberta's tourist season. It is inconceivable that this tourist season should continue to be shackled to the summer holiday season for schools.

If Florida and California depended, as Alberta does upon school holidays, they would have no tourist industry whatever. June, September and October are, by far, the finest months of the year in Alberta for those who

enjoy holidays in the spring or autumn but an untold potential, which is only now being realized, exists in the development of the winter season in the Canadian Rockies.

Thousands of Americans travel to France and Switzerland during the winter season. They are the wealthy class among whom money, time and the particular season of the year do not enter as a deciding factor when vacation time or pleasure travel are being considered. They want wintertime activities in luxury and are prepared to pay for them. If such activities are to be found in Switzerland wealthy tourists will go to Switzerland in winter; if in the Canadian Rockies they will come to Alberta in winter also.

The development of winter resort business in the Canadian Rockies has been hanging fire and making slow progress for a quarter of a century because federal parks officials, resort operators and railway executives were unable twenty-five or thirty years ago to anticipate future developments and, therefore, did not winterize accommodation then under construction. Winter resort business has been improved considerably in recent years by the construction of a chair lift and ski tows at Banff and some ski facilities at Jasper, Waterton Lakes and in the Crowsnest Pass. Therefore there is some evidence that its possibilities are beginning to gain recognition and there is reason to expect that, during the next ten years or so, it will also achieve a position of major importance in the economy of the province.

This position will not be achieved, however, without:

1. Expenditures by the railway companies and other hotel and accommodation enterprises.
2. Promotional effort similar to that used for the summer season.
3. Maintaining mountain roads open all winter.
4. Maintaining trained staff on a full-time basis.

Some of these obstacles are already being overcome. National Park building regulations stipulate that future tourist accommodation must be winterized. Railways and governments are both devoting more attention to the promotion of ski trains to, and winter sports in, the Canadian Rockies. For many years, the Alberta Travel Bureau in co-operation with the University of Alberta has promoted an inter-collegiate ski meeting which has drawn leading teams from British Columbia, Washington, Idaho and Montana.

A few years ago it was believed impossible to keep the Banff-Windermere highway open all winter but it is now an all-year route and the day is not far distant when the Banff-Jasper highway may also be kept open during the winter as is the very difficult Mt. Norquay road at present. Modern training facilities and inducements (referred to later) are already being organized to take care of the staff problem.

The possibilities for development of tourist attractions and activities in Alberta outside the National Park regions are almost limitless but their achievement—and consequent benefit to tourist traffic trends—may depend almost entirely upon the foresight or otherwise of educationists.

Except for cairns marking their locations, our historic sites remain for the most part undeveloped and, except for one in the University of Alberta, we have no real museum, yet, in many lands, the museum is the foundation upon which an educational system has been built.

It is a matter of record that hundreds of the most perfect specimens of prehistoric life have been taken, at great cost, from the valley of the Red

Deer River to museums in many of the distant education centres of the world but, with the exception of a specimen in the University of Alberta, no standing saurian remains are on display anywhere in western Canada.

Museums are considered a most magnetic tourist attraction in most metropolitan centres. A small admission charge usually provides funds for their maintenance when they have become well established. However, public funds are essential in their establishment and, when that has been accomplished, it has usually been the case that museum societies—organized around them—have assumed the duty of providing for legacies and private contributions which assist materially in expanding and maintaining the buildings and collections.

In many localities, historic sites provide the only attraction. Such a condition prevails to a great extent in places like New Mexico where historic sites and sunshine alone have been promoted into multi-million dollar attractions.

The development of historic sites does not always involve the construction of expensive buildings. Sometimes only a tea room employing a pioneer lecturer to recount stories of the past is sufficient to entertain and educate the tourist. In some instances, the development requires nothing more than a planned tour of the vicinity with a lecturer. However, the reconstruction of pioneer forts and trading posts where people in costume may re-enact events of the past or, possibly, deal in articles of pioneer or Indian handicraft do constitute a major tourist attraction. An outstanding example is the reconstructed Fort Henry near Kingston, Ontario, which is also used as a museum.

Provincial Parks are considered later under the heading of camping accommodations but, under the present heading of attractions, special mention must be made of the tremendous possibilities which await development in the Red Deer River Valley and especially in that region north of Brooks which was set aside in 1954 at a provincial park to mark Alberta's Golden Jubilee. Under proper management and direction, this region could be made into an educational and entertaining attraction unrivaled on the continent and when this is achieved it will improve further the trend of Alberta's tourist industry.

ACCESSIBILITY

Alberta's tourist attractions can be developed during the next thirty years only in direct ratio to the development of facilities including roads, train services, airports and landing strips, bus line facilities, passable pack trails, boat services, chair lifts, etc. which make them accessible.

The rapid development of all these facilities especially since 1945 has played a most important part in the post-war development of Alberta's tourist industry. In 1945, Alberta had less than 550 miles of paved highways (521.38 miles on Mar. 31, 1945) but on the same date in 1955, there were nearly 1,900 miles of pavement (1,879.28 on Mar. 31, 1955). A primary essential to the immediate further development of the tourist industry in Alberta is the extension and pavement of all highways within the National Parks. While the paving program is well under way and much has been accomplished during recent years, tourists who have returned at varied intervals complain because the Banff-Jasper Highway, and the highways to Miette Hot Springs and to Medicine Lake are not yet paved. Delay in the extension of the proposed highway around Medicine Lake into the Maligne Lake region and also of the proposed continuation of the highway from Jasper to Mount Robson continue to draw criticism from motorists. The com-

pletion of the Yellowhead route from Jasper to Blue River would attract large numbers of motorists both from Banff and Edmonton regions because it would provide an alternate route to Kamloops and the Pacific Coast.

Completion of the Trans-Canada Highway is now believed possible within a few years and, unquestionably, it will become one of the greatest factors in inducing interprovincial travel between the eastern and western provinces. It is not beyond a possibility that, when completed, the Trans-Canada Highway, as an inducement to Canadians to drive from coast to coast, may eliminate for some time the deficit which presently exists in the balance of tourist traffic between Canada and the United States and which, in 1954, amounted to approximately \$31,000,000 or about 11 percent of the Canadian total.

Train services have played a major role not only in making Alberta's attractions accessible but in publicizing them, providing accommodation facilities and in organizing special events for the entertainment of tourists. Airport facilities in the mountain regions are virtually undeveloped but strips have been provided for the accommodation of light planes and, of course, the major airports at Lethbridge, Calgary and Edmonton accommodate air passengers who may proceed from these centres by bus, private automobile or train to Waterton Lakes, Banff and Jasper National Parks respectively. Bus lines operate into the park areas especially during the summer season. Pack trails have existed since 1884 when the national parks system was inaugurated and boat services have played an important role especially at Waterton Lakes, Lake Minnewanka and in the Maligne River Basin in Jasper. Chair lift facilities are a recent development in the Banff region and, of course, ski tows of various types are operated during the winter in the Banff and Jasper regions.

Therefore, while there is still room for expansion and improvement of all forms of transportation, it is clearly evident that, since provincial approach roads to the national parks have been paved, federal policies with respect to highway construction will have an important bearing on the future economic trend of Alberta's tourist industry.

ACCOMMODATION

From the mountain chalet intended primarily for the accommodation of mountaineers, Alberta's tourist accommodation facilities have kept pace with the modern trend especially during the post-war years but are still woefully inadequate and, at present, are the restraining factor on the more speedy development of our natural and cultivated attractions. It is possible to accommodate less than 9,000 persons per night in hotels, motels, bungalows and private homes and not more than 5,000 per night in camps and trailers or a total of less than 14,000 persons per night in the entire mountain region including Waterton Lakes, Banff, Kootenay, Yoho and Jasper National Parks. Accommodations are of a very high standard and cover a wide price range but there is a serious shortage of good accommodation to meet the requirements of the average family in the middle and lower income brackets. A much larger number of fully equipped campgrounds should be provided especially along trunk highways.

With the exception of a few hotels and rooming houses, all of this accommodation is closed when the first frosts endanger water pipe lines. None of the luxury hotels and very few of the motels, bungalows and lodges in the national parks have been winterized. Therefore, such accommodation is serviceable only from about May 1st until October 15th each year. In fact

the luxury hotels are operated presently on a season of less than 120 days and the same applies to many of the motels and bungalow establishments.

Specifications were amended recently to require that, in future, tourist accommodation in the national parks must be winterized. This policy should have a decidedly beneficial effect upon the future trends of the tourist industry because in addition to ensuring all-year construction in the future, it may induce operators of existing accommodation to winterize their buildings.

PROMOTIONAL ADVERTISING AND PUBLICITY

Principal agencies presently carrying on promotional campaigns outside the province include both the Canadian Pacific and Canadian National Railways, the Canadian Travel Bureau, the Alberta Government through the Alberta Travel Bureau, the Calgary Exhibition and Stampede Association and a few individual resort operators.

A much more impressive impact on the public mind, and therefore upon the upward trend of the tourist industry, could be effected through a higher degree of co-operation in, and co-ordination of, advertising and promotional efforts employed by federal, provincial transportation and private promotional agencies. The Canadian Travel Bureau distributes to provincial, transportation and other agencies each year advance samples of advertising copy to be used in its selected publications together with the scheduled times of publication. Unfortunately this information arrives too late to be of much use to provincial authorities in laying their plans for the coming season. Each agency, therefore, operates upon its own with the result that some editions of leading magazines and newspapers appear with advertisements from many agencies while other editions appear with very little, if any, Canadian tourist advertising. The difficulty seems to lie in the fact that governments budget only for the year immediately ahead whereas, to make effective co-ordination possible, it might be necessary, as many leading commercial enterprises do, to plan advertising programs two years or longer in advance. Were such a policy followed, it would be possible for the various provincial and private agencies to plan their campaigns in magazines and newspapers as well as on the radio and television networks so that they might dovetail with the campaigns of the railways, airlines and the Canadian Travel Bureau. Such a policy would add impetus to the travel industry as a factor in Canada's economic future.

Canadians spend more on travel in foreign countries than foreign tourists spend in Canada and this condition creates a deficit in the travel account column of Canada's balance of trade. This deficit could be reduced considerably by selling Canadian travel more effectively to Canadians. To effect this purpose it will be necessary for the Canadian Travel Bureau to recognize that travel by Canadians in Canada is as important to the Canadian economy as travel by foreign tourists into Canada and that, therefore, its promotional advertising should be designed to promote interprovincial travel within, as well as foreign travel to Canada.

Further impetus would be added to the promotional efforts of provincial governments if the federal government were to inaugurate a system whereby provincial appropriations for tourist advertising were matched dollar for dollar under reasonable ceilings, placement of the advertising to be subject to the approval of the Canadian Travel Bureau and the provincial travel bureau concerned.

SERVICING TOURISTS

A continuous supervision and program of education will be essential to the continued development of high standards of service for the tourist who has been attracted to Alberta. Supervision outside national parks presently involves inspection, licensing and classification of motels, bungalows, tourist camps, etc. by the Alberta Government and municipal authorities. A major achievement which is expected to have highly beneficial effects on the future trend of the tourist industry was accomplished in September when representatives of the British Columbia, Alberta, Saskatchewan and Manitoba governments reached unanimous agreement on a method of inspection which will standardize the classification of tourist accommodation throughout all of western Canada. National park authorities have their own method for classification of tourist accommodation but the end result varies but little from that of provincial classification. All licensed tourist accommodation, including hotels which cater to the tourist industry or to hunters, are listed in the free government publications which contain the classification of the rental units, their number in each motel, and the classification of each.

The present program of education in Alberta consists principally of a campaign conducted by the Alberta Government Travel Bureau during the spring to impress all persons engaged in the tourist industry with the supreme importance of high standards of courtesy and service. Press and radio are employed to publicize the need for cleanliness and modern methods in accommodating, catering to and rendering roadside service to the motorist. Radio stations and the press, as well as Chambers of Commerce and the Alberta Motor Association, have entered into the spirit of the Tourist Courtesy Campaign by broadcasting and publishing news items, addresses by prominent government and civic authorities and by giving the motif of the campaign considerable publicity above and beyond the radio time and advertising space purchased.

However, to prevent foreign competition from interfering seriously with the upward trend of Alberta's travel industry, a much more thorough and specific type of craft and management education must be developed speedily and effectively to bring Alberta's catering and accommodation standards into better alignment with those of overseas as well as American continental resort operators where apprenticeship training prevails.

Realization for the need for specialized training has not past unheeded in Alberta. In the fall of 1949 through the co-operation of the Department of Education, a food service course was commenced at the Institute of Technology and Art in Calgary. The Department of Economic Affairs has provided three scholarships each year to encourage the students. The course has grown and, during the past two years, the Alberta Branch of the Canadian Restaurant Association has sponsored about fifty percent of the students by paying their tuition fees. In 1955 the Alberta Hotel Association entered the sponsorship plan.

In 1954, a short course for food handlers was conducted at the University of Alberta in co-operation with the Edmonton Branch of the Canadian Restaurant Association. Restaurant employees other than waitresses were also permitted time off and approximately 500 attended the lectures from which 143 waitresses graduated and received certificates of qualification from the Association. The course was so successful and had such a beneficial effect upon the improvement of food serving in Edmonton that, during the following spring, similar courses were conducted in Calgary, Banff and Lake Louise. Meanwhile, the Department of Agriculture conducted a trial

course in food storage, preparation and serving at the Fairview School of Agriculture for the benefit of hotel and restaurant operators in the entire Peace River district. As a result of the success achieved there, plans are being laid to conduct similar courses during the spring of 1956 in schools of agriculture at Vermilion and Olds.

The expansion of such educational efforts will proceed from year to year as government support continues and as competition induces larger numbers of operators to take advantage of the training thus afforded their staff members.

The day is not far distant when basic training, at least, in the proper care and handling of food will be as essential to the person seeking employment in an hotel or restaurant as training in shorthand and typing is to the person seeking employment in a business office. Likewise, the need for training in salesmanship is being recognized by many of the small as well as the larger retail merchandising establishments.

Since the trend toward better salesmanship in restaurants and retail establishments is already upward and because the value of the tourist industry depends upon the dollar value of food and merchandise sold, the upward curve of the value graph will improve as modern methods of education in catering and salesmanship become more intensively and extensively used.

INFORMATION SERVICES

Information services will continue to play a most important role in future tourist trade development. To the tourist, information about the condition of roads, the best route to follow, current events of special interest along the way, and advance arrangements for accommodation are vital factors in making a holiday thoroughly enjoyable. Therefore, the Alberta Travel Bureau, in co-operation with the Alberta Motor Association, Chambers of Commerce and the Canadian Rockies Tourist Association, has developed a very efficient system of distributing information which, in addition to road maps and accommodation booklets, includes a weekly road work report from May 15 to September 15.

A branch of the Travel Bureau has been established at Fort McLeod where all main highways from the south, west and east join to enter Highway No. 2 northward to Calgary. Virtually all northbound automobile traffic passes this point. A field supervisor and his wife are in residence there from March 1st until mid-December and a staff of assistants is employed during the summer months. Teletype and long distance telephone service is maintained with Waterton Lakes, Banff, Lake Louise, Calgary, Edmonton and Jasper by which tourists may make and pay for accommodation reservations in any of these places. In addition to supplying road maps, accommodation booklets, road information and information about district rodeos or other special events, the bureau issues fishing and hunting licenses and also export licenses for game birds and big game. During the 1955 season, approximately 50,000 tourists as compared with about 42,000 in 1954 registered at this bureau which, it is clearly evident, is improving the trend of tourist industry growth and development.

With the improvement of highways from both east and west in the northern sections of the province, the Hart Highway in B.C. and the completion of the Whitecourt-Valleyview Highway, the increased volume of

tourist traffic is creating a demand for similar information bureau services and plans are already under consideration for the establishment of another branch of the Alberta Travel Bureau somewhere between Edmonton and Carvel Corner on Highway No. 16. It is probable also that a similar branch may be necessary in the neighborhood of Medicine Hat when the Trans-Canada Highway is completed.

There is an increasing and urgent demand for improved roadside services along all trunk highways in Alberta. This demand must be satisfied if the highest possible future potential is to be reached. Service stations are being installed or improved at strategic points but, as yet, are lacking along some of the outlying highways and especially on the Mackenzie Highway, No. 35, from Grimshaw to Hay River on Great Slave Lake. The compelling urge to get into the farthest frontier regions is inducing an increasingly large number of motorists each year to drive over unimproved roads in the northern sections of the province and into the Northwest Territories. These motorists are willing to endure the hardships of poor accommodation and, frequently, take their own camping equipment, but they complain bitterly when they find it impossible to obtain gasoline and oil supplies and facilities for repairs to tires, motors and car bodies on such expeditions into remote regions. Such services in regions north of Alberta come under federal jurisdiction.

After all aspects of its numerous problems have been studied carefully and regardless of present and future obstacles and handicaps, the development of Alberta's tourist industry has begun to gather momentum. A nearby market of 150,000,000 Americans already mobile and wealthy is beginning to roll northward—regardless of the seasons. In 1954, Alberta received less than 3 per cent of those who crossed the Canadian border.

Alberta's tourist industry, therefore, has almost limitless possibilities and, under normal peace-time conditions, should assume a rapidly increasing importance in Alberta's economic future.

APPENDIX

Statistics used in this presentation are based upon:

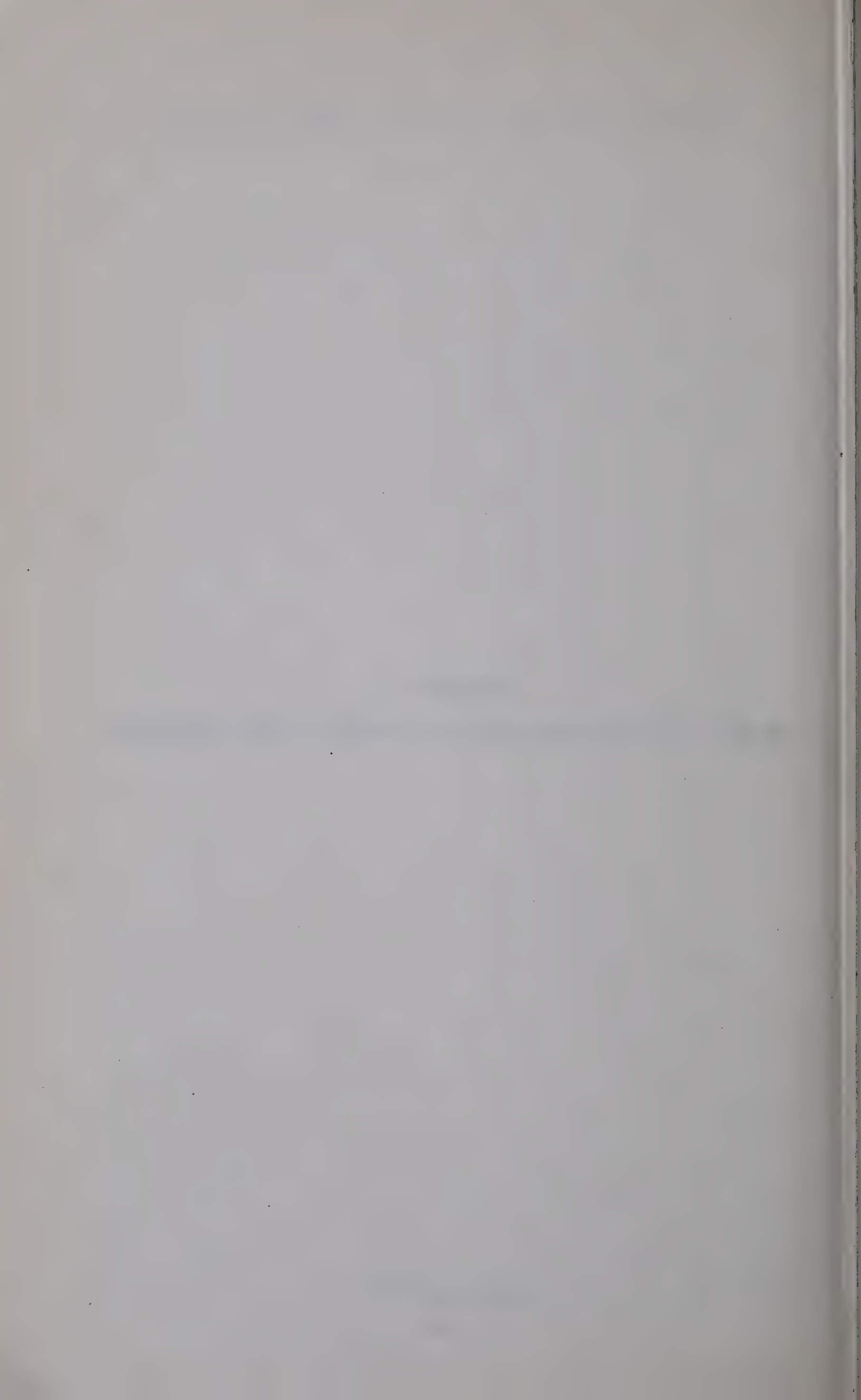
1. A year-round record of foreign cars and persons entering Alberta at customs ports of entry along the Montana border.
2. A count of all cars and persons entering National Parks in Alberta each year between April 1st and October 31st only.
3. Declarations of amounts spent by tourists leaving Alberta at customs ports, and declarations made by tourists in replying to questionnaires distributed by the Alberta Travel Bureau during the summer months only; estimates based upon the percentage of capacity business reported by resort accommodation operators; and reports of business volume by transportation companies.
4. No records are available to indicate the volume or value of non-resident Canadian travel to Alberta whether it enters through customs ports on the Montana border or through points on the British Columbia and Saskatchewan borders.
5. Dominion Bureau of Statistics records are used where they apply directly to tourist traffic to Alberta but these records can not apply wholly in the case of either Canadian or foreign railway traffic to Alberta because the main and connecting lines of both the Canadian Pacific and Canadian National railways enter Canada at customs ports other than those in Alberta. Example: Canadian Pacific tourist traffic from Chicago enters Canada in Saskatchewan and, although most of the passengers are bound for Banff or Lake Louise and pass through Saskatchewan during the night, they are shown in D.B.S. records as having entered Saskatchewan. A similar condition exists at most border crossing points farther east, but those in British Columbia receive the credit for all Alberta-bound tourist traffic from the west.

ALBERTA'S ECONOMIC PROSPECTS

SECTION III

PUBLIC SERVICES AND SOCIAL CAPITAL REQUIREMENTS

December, 1955.



ALBERTA'S ECONOMIC PROSPECTS

PROJECTION OF ALBERTA'S BUDGET 1956 TO 1985

Prepared by Treasury Department

HON. E. W. HINMAN,
Provincial Treasurer

K. J. HAWKINS,
Deputy Provincial Treasurer

ALBERTA

Provincial Budget Projected for the Years 1956 to 1985

Prepared For The Royal Commission on Alberta's Economic Prospects

The enclosed statements show a projection of total Provincial Expenditures and Receipts for the fiscal years ending March 31, 1957 and March 31, 1986. Estimated expenditures are based on trends and conditions as indicated by government departmental officials, and also to some extent on the necessity for keeping payments within reasonable distance of receipts and funds on hand. If the government's policies are maintained, the estimated expenditures should not be too far out, having in mind our growing population and economic expansion. Receipts are estimated to be just about as high as they might reasonably be expected to go.

It must be emphasized that our present budget of \$223,000,000 is a large sum to be spent in a Province with a population of just over 1,000,000 people. Such a budget must be considered to quite an extent to be rectifying the things which could not be done during the war and post war periods, and which are possible now because of our buoyant revenues. Events during the next thirty years could quite possibly produce conditions which would have a detrimental effect on our revenues, in which case expenditures would have to be curtailed to the same extent. The maximum budget of \$246,000,000 for the last year of the forecast period further emphasizes the fact that it is not considered practicable to expend an amount much greater than is being spent at present for a province of 1,000,000 or even 2,000,000 people.

The following descriptions of our main items of expenditure briefly outline the estimated trend over the next thirty years. The various departments of the government in their respective briefs will describe in much more detail the program of services which they expect to implement over the next thirty years.

ALBERTA

EXPLANATORY NOTES ON BUDGET FORECAST FOR THE YEARS 1956 to 1985

Highways — Construction & Maintenance

The present annual budget of \$56,000,000 is considered a maximum, and will likely be continued for the next five years to complete the presently planned highways program. Following the completion of this program some tapering off is contemplated, but not to any great extent. As the necessity for building new roads becomes less acute, the trend towards super-highways, cloverleafs and other structures will become necessary to accommodate the ever-increasing traffic-load.

Public Works — Construction and Maintenance of Public Buildings

As in the case of highways, the present program is considered to be a maximum for any one year. This program is expected to continue with almost the same intensity for the next five years. Following this period, the need for new buildings should decline somewhat, but our growing population will almost certainly demand the need for additional mental hospitals,

jails, University buildings, and other public bulidings. An accelerated budget is anticipated during the last ten years of the forecast period as repairs and renovations will undoubtably become essential at that time.

Education

Educational services and school grants will undoubtedly increase in relationship to our population growth throughout the forecast period. However, school construction grants should taper off somewhat after five years, as the back-log of replacing unsuitable school buildings should be completed by that time and subsequent construction grants would be required only for new classrooms required for the expanding school population.

Health and Welfare

The sums estimated to be spent on Public Health and Welfare are fairly well in proportion to the estimated population increase. A substantial increase in the patient population in sanatoria, hospitals and welfare institutions is anticipated as well as an expansion of general health and welfare services.

Agriculture

As Alberta is an agricultural province, the present services should be maintained and extended to meet the growing needs. In addition, irrigation projects presently under construction will be completed, and almost certainly further irrigation, and drainage works will be contemplated over the next thirty years.

Natural Resources

The present program of forest conservation, wild life protection and mineral development should be maintained, and expanded to meet the demands of our growing economy.

Other Expenditures

These are expenditures on Legislation, Administration of Justice, Public Debt, Industries and Labour and other general government matters. A steady increase is anticipated.

Loans

It is the Government's policy at present to make available by loan to Alberta Municipalities, sufficient funds to enable all Municipalities to finance their necessary capital expenditures, including schools and hospitals. To this end a fund of \$100,000,000 has been authorized by statute, and it is anticipated an additional sum will be made available. It is considered that the total amount will be loaned by 1959, and should be sufficient to enable the Municipalities to provide most of their capital requirements, with the exception of school construction. Loans for this latter purpose and also for the capital expansion of the Alberta Government Telephones will likely continue throughout the forecast period (although on a gradually reducing scale after 1959). Additional loans, although on a smaller scale will be made for Rural Electrification, Homesteading, and other purposes found necessary to keep pace with a modern growing Province.

ALBERTA

SUMMARY OF PROJECTED BUDGET — 1956 - 1985

Total estimated Budgets—1956 to 1985

Estimated Expenditures on:

Highways	\$1,530,000,000
Public Works	405,000,000
Education	1,486,000,000
Health and Welfare	1,337,000,000
Agriculture	257,000,000
Natural Resources	227,000,000
Other expenditures	978,000,000
Loans	441,000,000
Total Estimated Expenditures	<u>\$6,661,000,000</u>

Source of Funds:

Estimated receipts from:

Natural Resources	\$2,295,000,000
Taxation Agreement or Equivalent	1,450,000,000
Gas Tax and Motor Vehicles Licenses	1,230,000,000
Liquor profits	594,000,000
Other Receipts	979,000,000
Total Estimated Receipts	<u>\$6,548,000,000</u>

Liquidation of Investment Revenue } (presently \$100,000,000)	
or	
Borrowing } or	113,000,000
Some other new source of revenue }	
	<u>\$6,661,000,000</u>

ALBERTA
Budgets Approved by the Provincial Legislature—1910, 1920, 1930, 1940, 1950, 1955 and 1956-57 to 1985-86
ESTIMATED EXPENDITURES

Year	Highways	Public Works	Education	Health and Welfare	Agriculture	Natural Resources	Other Expenditures	Loans	Total Estimated Expenditures
1910	\$ 1,000,000	\$ 855,000	\$ 584,000	\$ 85,000	\$ 385,000	\$	\$ 2,069,000	\$	\$ 4,978,000
1920	1,613,000	2,405,000	2,045,000	490,000	2,661,000		6,565,000		15,779,000
1930-31	5,326,000	2,526,000	2,983,000	1,623,000	780,000		10,614,000		23,852,000
1940-41	2,725,000	1,392,000	3,003,000	3,974,000	1,210,000		8,613,000		21,513,000
1950-51	20,065,000	10,351,000	11,221,000	14,972,000	2,213,000	3,072,000	12,803,000	6,000,000	80,697,000
1955-56	56,511,000	17,741,000	34,471,000	32,792,000	6,902,000	5,212,000	26,334,000	43,000,000	222,963,000
Estimated Budgets									
1956-57	56,000,000	15,000,000	37,000,000	33,000,000	7,000,000	6,000,000	27,000,000	43,000,000	224,000,000
1957-58	56,000,000	15,000,000	39,000,000	34,000,000	7,000,000	6,000,000	27,000,000	43,000,000	227,000,000
1958-59	56,000,000	15,000,000	41,000,000	35,000,000	7,000,000	6,000,000	28,000,000	43,000,000	231,000,000
1959-60	56,000,000	14,000,000	43,000,000	36,000,000	7,000,000	6,000,000	28,000,000	43,000,000	233,000,000
1960-61	56,000,000	14,000,000	45,000,000	37,000,000	7,000,000	6,000,000	28,000,000	13,000,000	206,000,000
1961-62	50,000,000	13,000,000	45,000,000	38,000,000	7,000,000	6,000,000	29,000,000	12,000,000	200,000,000
1962-63	50,000,000	13,000,000	46,000,000	39,000,000	7,000,000	6,000,000	29,000,000	12,000,000	202,000,000
1963-64	50,000,000	12,000,000	46,000,000	40,000,000	8,000,000	7,000,000	30,000,000	11,000,000	204,000,000
1964-65	50,000,000	12,000,000	47,000,000	40,000,000	8,000,000	7,000,000	30,000,000	11,000,000	205,000,000
1965-66	50,000,000	12,000,000	47,000,000	40,000,000	8,000,000	7,000,000	30,000,000	10,000,000	204,000,000
1966-67	50,000,000	12,000,000	48,000,000	41,000,000	8,000,000	7,000,000	31,000,000	8,000,000	205,000,000
1967-68	50,000,000	12,000,000	48,000,000	42,000,000	8,000,000	7,000,000	31,000,000	8,000,000	206,000,000
1968-69	50,000,000	12,000,000	49,000,000	43,000,000	8,000,000	7,000,000	32,000,000	8,000,000	209,000,000
1969-70	50,000,000	12,000,000	49,000,000	44,000,000	8,000,000	7,000,000	32,000,000	8,000,000	210,000,000
1970-71	50,000,000	12,000,000	50,000,000	45,000,000	9,000,000	8,000,000	32,000,000	8,000,000	214,000,000
1971-72	50,000,000	12,000,000	50,000,000	45,000,000	9,000,000	8,000,000	33,000,000	10,000,000	217,000,000
1972-73	50,000,000	12,000,000	51,000,000	45,000,000	9,000,000	8,000,000	33,000,000	10,000,000	218,000,000
1973-74	50,000,000	12,000,000	51,000,000	46,000,000	9,000,000	8,000,000	34,000,000	10,000,000	220,000,000
1974-75	50,000,000	12,000,000	52,000,000	47,000,000	9,000,000	8,000,000	34,000,000	10,000,000	222,000,000
1975-76	50,000,000	12,000,000	52,000,000	48,000,000	9,000,000	8,000,000	34,000,000	10,000,000	223,000,000
1976-77	50,000,000	15,000,000	53,000,000	49,000,000	9,000,000	8,000,000	35,000,000	10,000,000	229,000,000
1977-78	50,000,000	15,000,000	53,000,000	50,000,000	9,000,000	8,000,000	35,000,000	10,000,000	230,000,000
1978-79	50,000,000	15,000,000	54,000,000	50,000,000	10,000,000	9,000,000	36,000,000	10,000,000	234,000,000
1979-80	50,000,000	15,000,000	54,000,000	50,000,000	10,000,000	9,000,000	36,000,000	10,000,000	234,000,000
1980-81	50,000,000	15,000,000	55,000,000	51,000,000	10,000,000	9,000,000	36,000,000	10,000,000	236,000,000
1981-82	50,000,000	15,000,000	55,000,000	52,000,000	10,000,000	9,000,000	37,000,000	12,000,000	240,000,000
1982-83	50,000,000	15,000,000	56,000,000	53,000,000	10,000,000	9,000,000	37,000,000	12,000,000	242,000,000
1983-84	50,000,000	15,000,000	56,000,000	54,000,000	10,000,000	9,000,000	38,000,000	12,000,000	244,000,000
1984-85	50,000,000	15,000,000	57,000,000	55,000,000	10,000,000	9,000,000	38,000,000	12,000,000	246,000,000
1985-86	50,000,000	15,000,000	57,000,000	55,000,000	10,000,000	9,000,000	38,000,000	12,000,000	246,000,000
Totals—	\$1,530,000,000	\$405,000,000	\$1,486,000,000	\$1,337,000,000	\$257,000,000	\$227,000,000	\$978,000,000	\$441,000,000	\$6,661,000,000

ALBERTA
ESTIMATED RECEIPTS—1956-57 to 1985-86

Year	Natural Resources	Taxation Agreement or Equivalent	Gas Tax and Motor Revenues	Liquor Profits	Other Revenues	Total Estimated Revenues
1956-57	\$ 75,000,000	\$ 36,000,000	\$ 30,000,000	\$ 16,000,000	\$ 24,000,000	\$ 181,000,000
1957-58	76,000,000	37,000,000	31,000,000	16,000,000	25,000,000	185,000,000
1958-59	77,000,000	38,000,000	32,000,000	16,000,000	26,000,000	189,000,000
1959-60	78,000,000	39,000,000	33,000,000	17,000,000	27,000,000	194,000,000
1960-61	79,000,000	40,000,000	34,000,000	17,000,000	28,000,000	198,000,000
1961-62	80,000,000	40,000,000	35,000,000	17,000,000	29,000,000	201,000,000
1962-63	80,000,000	41,000,000	35,000,000	18,000,000	30,000,000	204,000,000
1963-64	80,000,000	42,000,000	35,000,000	18,000,000	30,000,000	205,000,000
1964-65	80,000,000	43,000,000	36,000,000	18,000,000	30,000,000	207,000,000
1965-66	80,000,000	44,000,000	37,000,000	19,000,000	30,000,000	210,000,000
1966-67	79,000,000	45,000,000	38,000,000	19,000,000	30,000,000	211,000,000
1967-68	78,000,000	45,000,000	39,000,000	19,000,000	31,000,000	212,000,000
1968-69	77,000,000	46,000,000	40,000,000	20,000,000	32,000,000	215,000,000
1969-70	76,000,000	47,000,000	40,000,000	20,000,000	33,000,000	216,000,000
1970-71	75,000,000	48,000,000	40,000,000	20,000,000	34,000,000	217,000,000
1971-72	75,000,000	49,000,000	41,000,000	20,000,000	35,000,000	220,000,000
1972-73	75,000,000	50,000,000	42,000,000	20,000,000	35,000,000	222,000,000
1973-74	75,000,000	50,000,000	43,000,000	21,000,000	35,000,000	224,000,000
1974-75	75,000,000	51,000,000	44,000,000	21,000,000	35,000,000	226,000,000
1975-76	75,000,000	52,000,000	45,000,000	21,000,000	35,000,000	228,000,000
1976-77	75,000,000	53,000,000	45,000,000	21,000,000	35,000,000	229,000,000
1977-78	75,000,000	54,000,000	45,000,000	21,000,000	35,000,000	230,000,000
1978-79	75,000,000	55,000,000	46,000,000	22,000,000	35,000,000	233,000,000
1979-80	75,000,000	55,000,000	47,000,000	22,000,000	35,000,000	234,000,000
1980-81	75,000,000	56,000,000	48,000,000	22,000,000	35,000,000	236,000,000
1981-82	75,000,000	57,000,000	49,000,000	22,000,000	36,000,000	239,000,000
1982-83	75,000,000	58,000,000	50,000,000	22,000,000	37,000,000	242,000,000
1983-84	75,000,000	59,000,000	50,000,000	23,000,000	38,000,000	245,000,000
1984-85	75,000,000	60,000,000	50,000,000	23,000,000	39,000,000	247,000,000
1985-86	75,000,000	60,000,000	50,000,000	23,000,000	40,000,000	248,000,000
	\$2,295,000,000	\$1,450,000,000	\$1,230,000,000	\$594,000,000	\$979,000,000	\$6,548,000,000

ALBERTA'S ECONOMIC EDUCATION PROSPECTS

EDUCATION

Dr. J. W. Chalmers — Inspector of High Schools

Mr. E. W. Wood — Principal, Provincial Institute of
Technology and Art

Mr. R. E. Byron — Director of Vocational Education

DEPARTMENT OF EDUCATION

HON. A. O. AALBORG,
Minister

DR. W. H. SWIFT,
Deputy Minister

O U T L I N E

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Part I

THE ALBERTA PUBLIC SCHOOL SYSTEM

Preamble

The provision of educational facilities in Alberta during the next twenty to thirty years will be affected by two important trends: rising educational standards in the province, and a high and recently rising birth rate.

Improvement in educational standards is instanced by the following:

1. **Better attendance.** Percentage of attendance in Alberta schools rose from 80 in 1934-35 to 92 in 1953-54.
2. **Less retardation.** In 1934-35, 14% of Grade I pupils were repeaters. In 1953-54, the corresponding figure was 6%.
3. **Higher teacher qualifications.** In the ten-year period from 1943-44 to 1953-54, the ratio of high school teachers holding university degrees rose from 55% to 75%. (Available figures from 1934-35 are not comparable.)
4. **Lower teacher load.** The average number of pupils per classroom, which before 1934 was rarely less than thirty, has since that date never reached that figure.
5. **Longer school year.** In 1934-35, Alberta schools were open for an average of 184.61 days. In 1950-51, the last year for which comparable figures are available, this figure had risen to 189.86.
6. **Fewer ungraded schools.** On June 30, 1935, there were 2,934 one-room schools in operation in the province. By the end of the 1953-54 school year, this figure had dropped to 1,033, although in the interim the number of pupils in our schools had risen from 167,954 to 201,420.
7. **Longer attendance at school.** The following figures indicate for 1936-37 and 1953-54 the proportion of pupils in the senior grades as compared with the number who began school:

									1936-37	1953-54
Proportion	of	Grade	IX	to	beginners	9	years	previously	40%	73%
"	"	"	X	"	"	10	"	"	30%	52%
"	"	"	XI	"	"	11	"	"	22%	44%
"	"	"	XII	"	"	12	"	"	15%	41%

With the exception of the first two, all of the above factors have tended to increase the cost of Alberta's educational system. Furthermore, the trends which are herewith noted may be expected to continue. Other trends less susceptible to statistical analysis which will increase the cost of education should also be noted. These include rising teachers' salaries, increased educational services such as transportation, guidance, increased offering of special subjects, e.g. commercial courses, industrial arts, home economics; replacement of obsolete schools; the purchase or building of teacherages.

The other principal trend of which our schools must be cognizant is the provincial birth-rate. From a pre-war rate of about 21 births per thousand of population, the rate rose fairly consistently to more than 32

in 1954. Although this high figure will probably not be maintained, the Provincial Bureau of Statistics estimates that during the next thirty years it will not fall below 27, and remain at this minimum for five years only. Also affecting future school populations is the infant mortality rate, which has dropped from 48 deaths per thousand live births in 1940 to 26 in 1954. This figure may be expected to drop still further.

ESTIMATED FUTURE SCHOOL ENROLMENTS

Assumptions:

- 1. Population figures will be as estimated by Provincial Bureau of Statistics.
- 2. By 1965, the Grade I enrolment will equal the number of beginners, accelerated students off-setting in numbers the repeaters.
- 3. All children will remain at school until they have reached Grade IX.
- 4. Proportion of pupils leaving school at Grades IX - XII levels will decline in accordance with recent trends.

TABLE I
ESTIMATED FUTURE SCHOOL ENROLMENTS (to nearest thousand)

		1954	1965	1975	1985
GRADE	I	27.9	31.6	36.9	46.5
	II	23.5	30.9	36.2	45.4
	III	20.7	31.3	35.6	44.6
	IV	20.3	29.8	34.7	43.9
	V	20.0	30.7	32.9	42.9
	VI	18.6	34.7	32.4	42.1
	VII	17.4	30.7	31.6	41.4
	VIII	15.5	28.9	31.4	40.5
	IX	13.4	23.7	30.6	39.7
	X	9.9	17.2	28.7	33.8
	XI	7.9	14.7	25.3	32.5
	XII	6.3	14.4	22.5	28.6
Totals		207.0	318.6	378.8	481.9
Totals Gr. X-XII		24.1	46.3	76.5	94.9

Not only do these figures indicate a rapid expansion from the 1953-54 school population 201.4 thousand (the latest available figure), but when compared with the Provincial Bureau of Statistics population estimates for 1951, 1975 and 1985, they indicate that the proportion of school children in the total population will be much greater than heretofore. The proportion of school children and other groups to the total population is indicated below:

TABLE II

	1951	1975	1985
School Children	18.6%	24.6%	26.0%
Pre-school (Ages 0 - 5)	7.1	7.1	7.2
Over 65 (Presumably retired)	14.4	15.8	15.8
Balance (Housewives and working population)	67.9	52.5	51.0

These figures indicate that whereas in 1951, for every student in school there were 3.25 persons in economic employment or home-making, in 1975 and 1985 the corresponding figures will be 2.1 and 2.0. Thus relatively speaking, the burden of providing educational services to the children of Alberta can be expected to become much heavier than it now is, and at a time when the demand for social services for preschool children and older people will be increasing, albeit but slightly.

ESTIMATED FUTURE NUMBERS LEAVING SCHOOL

Assumptions:

The assumptions here are as for **Estimated Future School Enrolments**.

TABLE III

ESTIMATED FUTURE NUMBERS LEAVING SCHOOL (to nearest thousand)

Number Leaving		1965	1975	1984
Grade IX		4.9	3.8	3.7
Grade X		1.6	1.7	.7
Grade XI		1.0	1.9	2.9
Grade XII		13.7	23.4	28.6
		21.2	30.8	35.9

In 1954 an estimated 13,862 students left school for further study, employment, or homemaking. This figure was 1.31% of the province's total population. In 1965, 1975, and 1984 the corresponding percentages will be 1.69, 2.03 and 1.98. The increase reflected by these figures may mean more serious competition for available jobs open to young people, increased emphasis on specialized training, and increased availability of trained nurses, teachers, stenographers, and workers generally. On the other hand, the decreasing proportion of the population engaged in economic employment may mean that even more job opportunities may exist than is presently the case.

ESTIMATED NUMBER OF TEACHERS REQUIRED

Assumptions:

1. One teacher will be needed for each twenty-eight pupils. (In the past twenty years this figure has never been higher than twenty-eight.)
2. Five per cent of the teachers in any one year will drop out of the schools, either temporarily or permanently. This estimate was reached after a study of the number of classrooms operating and the number of new certificates issued from 1950 to 1954.

TABLE IV

ESTIMATED NUMBER OF TEACHERS REQUIRED

	1965	1975	1985
Total Number of Teachers Required	11,400	13,500	17,200
Number of New Teachers Required	950	880	1,190

During the five-year period 1950-54, first teaching certificates were issued to 3,596 teachers, an average of 719 per year. During the next decade, a total of 8,740 new teachers will be required, or an average of 874 per year. These must be trained in Alberta, or induced to move to this province. Should the teacher-turnover be greater than the very conservative figure of 5%, the need will be proportionately greater.

ESTIMATED NUMBER OF CLASSROOMS REQUIRED

Assumptions:

1. A new classroom will be required for each 28 new pupils.
2. The 5,815 classrooms in existence in 1935 will be completely replaced by 1985, at the rate of 2% per year.

TABLE V
ESTIMATED NUMBER OF CLASSROOMS REQUIRED

	Ten-Year Period Ending	1965	1975	1985
New classrooms required	-----	4,080	2,050	3,600
Replacements required	-----	1,163	1,163	1,163
Totals	-----	5,234	3,213	4,763

For the next ten years, then, an average of 524 classrooms per year should be built to take care of the expanding population and the attrition due to fire losses (almost negligible), obsolescence, and movements of school population. During the five-year period 1950-54 this figure was approached, when a total of 1,980 rooms were completed, or an average of 396 per year. However, analysis of the figures indicates that in the urban areas (Greater Edmonton, Greater Calgary, Lethbridge, Medicine Hat, and Red Deer), the number of classrooms built (615) did not even equal the number of new classrooms opened (656). Obviously no classrooms were written off as obsolete.

In the rest of the province, however, the number of classrooms built was 1,165, whereas the increase in the number in operation was only 264. Evidently, 901 obsolete rooms (including 672 one-room schools) were replaced.

Although in the non-urban parts of the province, definite steps are being taken to replace obsolete buildings, the problems of obsolescence will become increasingly serious in the urban centres during the years ahead.

ESTIMATED COST OF NEW SCHOOL CONSTRUCTION

Assumptions:

1. Cost levels will remain at those estimated for building under construction during 1954.
2. Gymnasiums, industrial arts shops, home economics centres and other special subject facilities will be constructed in the same proportion as obtained for buildings under construction during 1954.
3. Classrooms will be built in accordance with estimates of needed rooms as indicated in Table V.

During 1954, 1,175 basic classrooms and ancillary rooms were under construction. Their cost was estimated at \$32,761,170. If one classroom is needed for each 28 pupils, and if other school facilities, e.g. gymnasiums, libraries, etc., are erected in the same proportion as was the case during 1954, the estimated cost of new school construction for the next three decades will be as follows:

TABLE VI
ESTIMATED COST OF NEW CLASSROOMS

Ten-Year Period Ending	1965	1975	1985
New Classrooms required _____	\$ 5,234	3,213	4,763
Total Cost _____	\$146,000,000	\$90,000,000	\$133,000,000
Average annual cost _____	\$ 14,600,000	\$ 9,000,000	\$ 13,300,000

SOME IMPLICATIONS FOR THE DEPARTMENT OF EDUCATION

During the next thirty years, changes in Alberta's educational pattern will have important implications for the Department of Education. Assuming that the government's educational policies remain substantially unchanged over that period, changes will affect the various branches of the Department very unequally. Regardless of the size to which the Department might grow, it is apparent that each branch will continue to have only one head. Only one Minister, one Deputy-Minister, one Chief Superintendent, etc., will be required, even though their respective staffs may increase.

Inspection Branch

Despite the expected rapid increase in school population, the number of divisional superintendents, who are members of the Department's staff, may be expected to increase but slightly. Recent re-organization of the school administrative units in Alberta now embraces almost all of the settled areas of the province. A very few additional such areas may be organized in the future, but most of the expected increase in population will occur in areas now settled. In such areas, increase in supervisory duties will probably be performed by locally-employed officials, although two or three more Superintendents-at-Large may be appointed by the Department. As the urban areas develop, locally appointed superintendents may be expected to relieve the Departmental superintendents of much administrative as well as supervisory work. Recent examples of this trend may be seen in Wetaskiwin, Red Deer, and Jasper Place.

However, demand for the services of other members of the Inspection Branch may be expected to increase. It is anticipated that the most rapidly growing part of our school system will be the high school, comprising Grades X - XII. During the next ten years, while the total school population will be increased by not quite one-half (see Table I), the high school population will more than double. By 1975, the total school population will be almost doubled compared to the 1954 figure, while the high school population will be multiplied fourfold. These changes indicate a probable need for a substantial increase in the number of high school inspectors and also special-subject supervisors, now confined to the fields of home economics, industrial arts, and guidance. Not only will their number need to be increased, but probably other special areas will also demand the services of specialist supervisors, e.g., physical education, music, agriculture, commercial education, and school libraries.

It may be expected that the Department will become increasingly concerned with the education of handicapped children. Welfare services, e.g., schools, hospitals, libraries, have been traditionally developed by voluntary agencies. However, as their worth becomes evident, more and more they tend to be taken over by local or other government. At present, schools for handicapped children in Edmonton, Calgary, Grande Prairie, and per-

haps elsewhere are being pioneered by private agencies, with some public support. It may be anticipated that eventually these will come more closely under the direction of the Department, and a supervisor for such endeavors be appointed.

Only very moderate expansion in our Curriculum Branch may be expected, simply because preparation of curricula for a school population of four or five hundred thousand students appears to be no more difficult than provision of the same service for two hundred thousand.

However, the work of the Examinations Branch, which now tests students at the end of Grades IX and XII, may be expected almost to double within the next ten years, at least as far as the marking of examination papers and the maintenance of students' records is concerned, although there should be little increase in the work of setting the examinations.

Other offices of the Curriculum Branch will be variously affected. Increased demands, proportionate to the increased number of teachers and classrooms, will no doubt be made on the Audio-Visual Aids Branch and the Teachers' Service Bureau, but the School Broadcasts Branch may expect its present services to be adequate, regardless of the size of the school population, unless it enters the television field.

The work involved in the Registrar's office may be considered to be proportionate to the number of teachers employed in the province. As such, it will increase with the expected increase in the number of teachers, probably demanding the appointment of an Assistant Registrar before long.

The same situation holds for the office of the Co-ordinator of Teacher Education. The need for in-service teacher education will grow as does the number of teachers. The head of this office will perhaps also require an assistant within ten years.

School Book Branch

Demands on this Branch will increase faster than the school population because the largest anticipated rate of increase is at the high school level, where each student requires more books and more expensive books than at the lower grade levels. It may be surmised that though the number of titles which this Branch handles will be substantially the same as at present, the volume of business which it transacts will increase substantially. However, it should be noted that this Branch operates without cost to the government, its expenses being met by profits on books handled.

Correspondence School Branch

This Branch exists to serve educationally handicapped children, particularly those in frontier and semi-frontier areas. As such, its services will be needed for a long time to come, but probably with little expansion above present levels, unless the teacher supply situation becomes acute.

School Administration

The work involved in the organization of school administrative units should not be extensive in the future, considering the administrative reorganization which has recently been completed in Alberta. However, there will still remain problems connected with the creation of school districts in frontier areas, the erection of separate school districts, the creation of

one or two new school divisions, the occasional change in school district or division boundaries.

In other administrative areas, a continuous growth may be anticipated. These include school grants, school buildings, school borrowings, financial statements and budgets, assessments and taxation, boards of centralization, and the training of local school officials. To handle these increasingly heavy burdens, increased staff will no doubt be required.

New Services

With the expanding school population and increasing complexity of Alberta society resulting from greater urbanization and growing industrialization, new services will no doubt be demanded of the Department, although it is difficult to anticipate these in advance. They might include a testing and research office, greater encouragement of night schools, on-the-job training of non-departmental school supervisors and principals, and many other services to meet the increasing demands on the Department for information, advice, and assistance in solving educational problems.

Finances

With the school population becoming an increasingly greater part of the total population, and with children remaining longer in school, the cost of providing school services will become correspondingly heavier than at present. Inevitably, greater demands will be made on the Provincial Government for support of our schools.

PART II

CONSIDERATIONS AFFECTING THE TRAINING OF TECHNICIANS IN CANADA

Canada's economic prospects are inseparably linked with its industrial development. This in turn is partly dependent upon an adequate supply of suitably trained technical personnel. That shortages of highly trained technicians exist is evidenced by the fact that some United Kingdom manufacturers are unable to establish branch factories in Canada because suitably trained technicians are not available. Statements to this effect have been made by members of the Athlone Fellowship Board and visiting United Kingdom industrialists. Furthermore, the existing facilities for training technical personnel are inadequate for the number of technicians required.

During the post-war years a great deal has been said and written about the shortage of engineers in Canada. This numerical shortage could be appreciably reduced if the semi-professional work and routine jobs presently undertaken by engineers were assigned to technicians who are trained specifically for semi-professional tasks. Under this arrangement university trained engineers would be assigned to the design and research tasks for which their training fits them and the semi-professional routine jobs, which hold little interest or challenge for engineers, would be satisfactorily handled by technicians. It is obviously uneconomical to employ engineers to perform semi-professional functions.

Technicians are the graduates of Technical Institute courses. These courses are terminal. Their purpose is to prepare individuals for various

technical positions or lines of activity encompassed within the field of engineering. The scope of each programme is more limited than that required to prepare a person for a career as a professional engineer. Courses of instruction are essentially technological in nature and have a sound foundation based on the principles of science. The courses include sufficient post-secondary school mathematics to enable each student to accomplish the technical objectives of the curricula. Emphasis is placed upon the use of rational processes in the principal fundamental portions of the curricula that fulfill the stated objectives and purposes. Programmes of instruction are briefer, and usually more completely technical in content than professional curricula, though they are concerned with the same general fields of industry and engineering. They do not lead to the baccalaureate degree in engineering. Such designations as Technician, Technical Aide, Engineering Aide, Associate in Engineering, and Engineering Associate are appropriate designations to be conferred upon graduates of programmes of the technical institute type. Training for artisanship is not included within the scope of education offered at technical institutes.

The attention of the Commission is respectfully drawn to the following information:

1. An article entitled THE DESIRABILITY OF ESTABLISHING TECHNICAL INSTITUTES IN CANADA by Dr. C. R. Young, Dean of the Faculty of Applied Science and Engineering, University of Toronto, and published in the March, 1944, issue of The Engineering Journal, was submitted to the Council of the Engineering Institute of Canada on February 9th, 1944.
2. The Royal Commission on Veterans' Qualifications (Bovey Commission) 1945 recommended the establishing of technical institutes in Canada. An extract from Section No. 10, recommendation number 3A of the Commission's report reads as follows:

"Recommendation No. 3A

During the sittings of the Royal Commission on Veterans' Qualifications in Montreal, 21st May to 14th June, when reports were heard from personnel of the Forces on Service trades, courses of training and qualifications, the matter of technical training on the level between Technical High Schools and Universities was under discussion.

The establishing of Technical Institutes in various provinces is a subject which is now very much in the public eye and is doubtless one that is receiving the serious attention of the responsible Dominion and Provincial technical educational authorities.

The evidence submitted to this Commission indicates that heretofore there have existed, and still exist, serious deficiencies, not only in the opportunities offered to those desirous of securing technical knowledge but also for the necessity of securing such knowledge. Industry has been content to produce tradesmen possessing hand skills but woefully lacking in technical knowledge. If Canadian industry is to retain any semblance of continuing leadership in the international field, industries' foremen must be technically qualified and every apprentice should be a potential

foreman. Such a philosophy necessitates at once the initiation of technical education for apprentices.

This Commission realizes that the apprenticeship Acts being enacted by the provinces will enforce a correction in the deficiency in technical education in the training of apprentices. However, such legislation suffices also to magnify the deficiency in Canada of institutions where such education may be obtained. Such training to be effective must necessarily be above the level of that given in Technical High Schools, and for purposes of incentive should, by arrangement with the Universities, if possible, be so designed as to qualify in credits toward a University degree in engineering, or should at least be directed toward student membership examinations of the professional engineering societies.

An educational programme of this type requires at once the establishing of Institutes of Technology, suitably staffed, well equipped and prepared to offer day and evening courses.

The Commission has had its attention directed to the memorandum by Dean C. R. Young of the University of Toronto, a copy of which is attached.

This Commission recommends that in order to ensure the proper establishment in civil life of the highly trained personnel to whom its attention has been directed during its hearings of evidence from members of the Navy, Army and Air Force and to render the asset that the country possesses in these men and women of the utmost value, and further to ensure the existence in Canada of adequate and modern technical instruction, the Provinces be invited to establish forthwith technical institutes of the nature above described and that in view of the national value of such training the necessary funds be provided by the Federal Government, and further that the courses of such institutes be so designed as to be later extended to the farthest point which can usefully be attained."

3. The following statement made by Colonel W. L. Sagar, President of the Dominion Council of Professional Engineers 1954-55, is copied from the July, 1955 issue of THE CANADIAN PROFESSIONAL ENGINEER:

"Also referred to by the President was the role of technical institutes as affecting the engineering profession. On a number of occasions, he stated, engineers have suggested that junior engineers, and those even beyond this stage, have been kept at work which could be satisfactorily handled by trained technicians. Replacement of such engineers by the graduates of technical institutes could make it possible, it is contended, to assign the engineers to undertakings for which they are better qualified. This would provide a certain relief to any shortage of engineers which may exist and would also eliminate the sense of frustration experienced by those engaged in routine work of a sub-professional level.

To train such technicians requires institutes which are adequately staffed and equipped. While commonplace in the United Kingdom and Europe, their number in Canada is still small. A full appreciation however of the service rendered by technical institutes

may result in more attention being paid to this valuable and necessary part of our educational system."

4. The following statement appeared on the editorial page of the July, 1955 issue of the magazine AIRCRAFT:

"Cut and Try

The recent discussions at the Canadian Aeronautical Institute annual meeting concerning aeronautical education in Canada point up the fact that this country has no co-ordinated training program designed to provide the aircraft industry with a steady flow of technicians. Nor does it have any overall scheme whereby technical personnel can improve their education and hence qualify themselves for more responsibility, more technically demanding tasks.

It is true that some of our larger firms now have, or are introducing plans to enable graduate engineers to take more advanced studies. It is also true that at the other end of the technical scale, at the shop level, apprentice schemes provide varying degrees of training to youths who are interested in making a career in the aircraft industry and working their way up from the bottom, the so-called 'hard way'. But between these two extremes there appears to be an educational desert.

Basic Cause: This educational desert is, we think, one of the underlying causes for the much-discussed engineer shortage. In actual fact, we suspect there is not so much an engineer shortage as there is a shortage of technically-qualified personnel of non-graduate status. How many graduate engineers now spend much of their time performing tasks which could be just as well handled by a well-trained and experienced technician? We have no hesitation in saying that the engineering man-hours consumed in this way are considerable and were sufficient numbers of technicians available, the engineer shortage would be, if not resolved, certainly eased.

Some thought should be given to a workable irrigation scheme for this educational barren land. The youth who qualifies in the shop can perhaps put his training to good use in obtaining an "M" engineer's certificate (and the inducements to do this are apparently very slight, since the numbers of "M" engineers have been declining steadily for the last few years), but where else can he look?

Many Opportunities: There are an incredible number of opportunities in the aeronautical field for the bright young man, but where can he go to qualify himself to take advantage of them? So far as we know, there are no formal courses of supervised studies available anywhere in Canada designed for the more advanced aeronautical technician. He can pick up the practical aspects in uncertain fashion over the years, but the theoretical side is not so easy to come by. The truth of the matter is that in Canada today, the budding aeronautical technician must find his own way. It strikes us as an almost unbelievable anomaly that an industry that prides itself on its precision methods should accept such 'cut and try' training.

So far we have been able to get along by using engineers in technicians' jobs, and by getting some British technicians to emigrate to this country. The first instance represents uneconomic utilization of our engineering brains. In the latter case, the source of supply has just about dried up. What this all adds up to is that we can no longer depend on others for our technicians. We should start laying the foundation now for a broad program of aeronautical training that will in the future assure us of a continuous supply of technically qualified personnel."

The editor of AIRCRAFT has since been informed of the Aeronautical Engineering course offered at the Provincial Institute of Technology and Art, Calgary. The number of aeronautical technicians trained annually at the Calgary institute is woefully short of the number required. Personnel officers of the leading Canadian aircraft industries have been obliged to go to Europe for technicians.

5. In the May 30th, 1955 issue of TIME a box article on THE ENGINEER SHORTAGE contained the following statement:

"But the greatest contribution that industry can make toward meeting the shortage is to use engineers as they should be used, and not on marginal tasks that could be handled by lesser-trained personnel. Says F. W. Trezise, associate dean of the University of Illinois' undergraduate engineering division in Chicago: 'Many companies are putting engineers in as sub-professionals in jobs which could be handled by technicians.'

"Some experts estimate that the companies could cut in half the number of engineers they employ if they used them only for engineering jobs, stopped wasting them on drafting and lesser tasks that men without degrees could do just as well. Sooner or later, corporations will have to change their ways simply because there is no quick solution of the shortage in sight."

From the foregoing information two important conclusions may be drawn, namely: (a) The engineer shortage will be partly relieved when technicians are available in sufficient number to replace them in marginal tasks and routine work. (b) A sufficient number of technicians will not be available until additional technical institutes are built and staffed and students are counselled and directed to them. It is submitted that many students who gain admission to universities lack the special gifts necessary for the successful completion of university undergraduate courses. These students, together with those who fail to attain university entrance because of deficiencies in one or two subjects other than science and mathematics, would have been better served had they been counselled to enrol in courses of the technical institute type.

It is therefore respectfully submitted, on the basis of the information presented to the Commission in this brief, that Canada's economic development will be retarded unless steps are taken to provide the facilities for training a sufficient number of technicians to meet Canada's growing industrial needs.

PART III

VOCATIONAL TRAINING IN ALBERTA

Assumptions:

1. A higher proportion of the forecast increased population will be employed in occupations related to the developing industrialization of the province, and will require training for those occupations.
2. Expenditures for vocational training facilities and services over the past five years provide a reasonable basis for prediction of requirements for the period of forecast.

APPRENTICESHIP TRAINING

The following data illustrates the development of this aspect of vocational training, and anticipated requirements in ten year intervals:

TABLE VII
APPRENTICESHIP TRAINING IN ALBERTA

Year	Number in Training	Ratio of Apprentices to General Population	Provincial Expenditures
1950	1,977	1 : 462	\$207,000
1951	1,655	1 : 567	258,000
1952	2,039	1 : 475	345,000
1953	2,088	1 : 479	423,000
1954	2,025	1 : 513	447,000
1955	2,107	1 : 505	453,000
1965	2,780	1 : 450	559,000
1975	3,370	1 : 450	649,000
1985	4,110	1 : 450	759,000

For purposes of forecasting, it is assumed that the ratio of apprentices to general population will increase because more trades will be designated, and a higher proportion of indentured apprentices will attend school. About two thirds of registered apprentices now attend school, but the costs of administration and of field supervision of all apprentices are included above. It is assumed that 50% of costs will not increase at the same rate as increased numbers in training, and that rising costs became stabilized in 1955.

Within the next five-year period, capital expenditures in the amount of \$300,000 will be required to replace existing obsolete training facilities. Indications are that within the following ten to fifteen year period, consideration must be given to additional training facilities at an estimated cost of \$500,000.

It should be noted that on the basis of present Federal-Provincial Agreements, the federal government will reimburse approximately 50% of provincial expenditures for apprenticeship training.

INSTITUTE OF TECHNOLOGY AND ART

A full development of the need for training at the technician or sub-engineer level is contained in Part II of this report. This section is confined to monetary considerations.

The following tabulation indicates the growth of Institute enrolments in comparison with general population and forecasts estimated expenditures. This information includes only day enrolments, although expenditures are gross figures less expenditures for apprenticeship training.

TABLE VIII
ENROLMENTS AND EXPENDITURES INSTITUTE OF TECHNOLOGY AND ARTS

Year	Day Enrolment	Provincial Expenditure
1953	690	\$383,300
1954	726	446,200
1955	701	438,800
1965	850	510,000
1975	1,028	616,800
1985	1,254	752,400

Forecast figures for expenditures are based upon the average per-pupil expenditure for 1953, 1954, and 1955.

In addition to these expenditures, very substantial capital expenditures may be expected for expansion of facilities, including those already in the planning stage.

GRANTS TO SCHOOLS FOR VOCATIONAL EDUCATION

Under the existing grants structure, no differentiation is made between facilities and services devoted to optional subjects, which may be a part of general education, and grants for facilities and services which are considered vocational in the sense that they prepare students for direct entry to employment.

The tabulation indicates combined capital and operating grants for vocational facilities and services on the following assumptions:

1. Vocational facilities (technical, commercial, home economics, and agriculture) constitute about 12% of the total cost of construction.
2. Projected grants are based on an average grant of 67c (average for 1954 and 1955) per person of the general population.

TABLE IX
GRANTS TO VOCATIONAL EDUCATION

Year	Combined Capital and Operating Grants	Grant per person of general population
1950	\$ 193,869	\$0.22
1951	391,559	.42
1952	269,490	.29
1953	445,923	.44
1954	747,465	.72
1955	679,000	.63
1965	840,000	.67
1975	1,016,000	.67
1985	1,239,000	.67

A proposed Federal-Provincial Agreement is expected to bring substantial reimbursement of provincial expenditures, from the federal government.

CANADIAN VOCATIONAL TRAINING ACTIVITIES

This Branch administers training programs including:

- Training of the unemployed
- Training of the handicapped
- Grants to university students and student nurses
- Supervisory training
- Youth training

It is assumed that expenditures on behalf of activities will grow in proportion to the population growth over the past three years, for the period of forecast.

TABLE X
CANADIAN VOCATIONAL TRAINING EXERCISES

Year	Expenditure	Expenditure Per 1,000 Population
1950	\$148,500	\$ 113
1951	194,000	207
1952	246,000	254
1953	233,000	233
1954	237,000	228
1955	204,000	248
1965	295,000	236
1975	358,000	236
1985	437,000	236

With particular respect to the rehabilitation training of the handicapped, it has been proven that such training is economically desirable, and that expenditures are exceeded over a period of time, by savings in direct relief and in income taxes on the salaries of rehabilitated persons. The evidence is that in the future, provision must be made for training facilities particularly designed for the handicapped, but presumably also available for training of the unemployed. Such facilities will cost about \$300,000.

ALBERTA'S ECONOMIC PROSPECTS

MUNICIPALITIES

AND

DEPARTMENT OF MUNICIPAL AFFAIRS

Prepared by:

T. D. BRUCE,
Research Worker.

THE DEPARTMENT OF MUNICIPAL AFFAIRS

HONOURABLE A. J. HOOKE
Minister

A. W. MORRISON
Deputy Minister

Economic Prospects Commission

Department of Municipal Affairs

MUNICIPALITIES

It is the policy of the Alberta Provincial Government to encourage the people of the province to accept local self-government as soon as it is economically feasible for them to do so. However, due to physical features and the fact that it is a comparatively young province, we have large sparsely settled areas in which the Provincial Government must assume the responsibility for government.

At the present time the province consists of the following municipalities:

8 Cities
75 Towns
146 Villages
229 Urban Municipalities
7 Counties
43 Municipal Districts
50 Improvement Districts
2 Special Areas
102 Rural Municipalities
331 TOTAL

Due to the recent revision of rural municipal boundaries brought about by the recommendations of the Co-terminous Boundary Commission and geographical features, no major changes are anticipated in rural municipalities in the foreseeable future. There will always be minor adjustments. Some municipal districts may become Counties and some of our unorganized areas may become self-governing. However, no great change is looked for in the overall number of rural municipalities.

It is felt that any increase in provincial population will be mainly urban in character. Based on an expanding economy, it is thought that future trends could be best judged by developments over the past fifteen years. The urban population has more than doubled whereas the rural population will probably remain in the 4 to 5 hundred thousand range. Therefore the problems of providing services for health, welfare, education, etc., will tend to become more accentuated in the urban centres.

URBAN POPULATIONS

	1941	1946	1951	1955
Cities	216,000	252,000	342,000	450,000
Towns	58,000	67,000	99,000	135,000
Villages	30,000	33,000	46,000	50,000
TOTAL URBAN	304,000	352,000	487,000	635,000
TOTAL RURAL	492,000	451,000	452,000	431,000
GRAND TOTAL	796,000	803,000	939,000	1,066,000

From the point of view of population, the towns of Beverly, Jasper Place and the proposed town of Campbelltown in the Edmonton area and the towns of Bowness, Forest Lawn and the hamlet of Montgomery in the Calgary area could reach the status of Cities. In fact Jasper Place in this respect is in excess of the Statutory requirements. Pending developments brought about by the report of The Royal Commission on Metropolitan Development of Calgary and Edmonton, these centres will be considered part of Edmonton and Calgary. At the present time this leaves only the town of Grande Prairie which might become a city. With a continued steady growth as over the past fifteen years, we will therefore have nine Cities with a total population of 900,000.

Natural resources and industrial development could account for several new towns such as presently planned for Drayton Valley and Hinton. Regardless of this factor, we have had a steady average increase over the past fifteen year period of two towns per year. During this time the average total number of villages has not changed. For every new village formed, one has been elevated to the status of a town. It is therefore conceivable that new towns will be formed at the rate of at least one per year and by 1985 we will have 105 towns with a population of 300,000 and about the same number of villages or 150 with a population of 75,000.

In Alberta at the municipal level we have three divisions of government - Municipalities, School Divisions and Districts and Hospital Districts. Each of these bodies are self-governing within the provisions of the various Provincial Acts covering their set-up and mode of operations. Each is responsible for its own expenditures but as municipalities are the only taxing authorities, the other two requisition the municipalities for that part of their expenditures required from taxation. Other health and welfare services and road programs are so interwoven with both Dominion and Provincial government expenditures that it is impossible with the information available to properly assess at the municipal level their present or future part in these undertakings.

Any municipal debt that cannot be provided for out of money on hand and the current year's revenue must by Statute be covered by debenture borrowings. The restricted building programs of the late thirties and the following war years created a large postwar demand for capital expenditures such as municipal buildings (not including schools and hospitals), roads and sidewalks and sewer and water systems. Except for a negligible amount, the entire debenture debt has been contracted by urban municipalities.

At the present time both capital liabilities and yearly expenditures are approximately four times greater than they were ten or twelve years ago.

OUTSTANDING MUNICIPAL DEBENTURE DEBT

1946	-----	\$ 30,500,000
1951	-----	72,500,000
1954	-----	138,500,000

YEARLY MUNICIPAL REVENUE FUND EXPENDITURES

1943	-----	\$ 24,000,000
1946	-----	30,500,000
1951	-----	57,000,000
1954	-----	90,000,000

The preparatory research and study necessary to properly interpret the municipal position in relation to the economic picture has not been made by this department and we do not feel competent at this time to judge their future role in this respect. It is submitted that this is a vast field of study that could be profitably followed up by this department.

THE DEPARTMENT OF MUNICIPAL AFFAIRS

In a broad sense the functions of the Department of Municipal Affairs can be broken down under the two headings of administration and service.

In its administrative capacity the department is mainly concerned with the rural areas comprising improvement districts and special areas which are the areas of the province that have not reached a degree of development sufficient to warrant local self-government. To all intents they are geographically the same as other rural municipalities, offer the same services and differ from organized rural municipalities only in the respect that Provincial Government Officials are in charge of their affairs in place of a locally elected Council. Under this heading the staff of this department may be grouped as follows:

- (a) **Accounts Office:** In addition to the normal government accounting work, this branch under the supervision of an administrative accountant performs the duties for all improvement districts usually carried on by a Secretary-Treasurer and office staff in each county and municipal district.
- (b) **Special Areas Board:** A government board with headquarters in Hanna carries on the same functions as the Council, office and field staff of an organized rural municipality.
- (c) **Field Service Branch:** Under a Supervisor and correlated with the Accounts Branch, this branch carries out the assessment and other field work in Improvement Districts. In place of an elected council, the personnel of this branch serve as a direct contact with the people.
- (d) **Mechanical Accounting Branch:** This branch has the facilities for mechanically keeping the accounts and records of the improvement districts and special areas. It is also called upon to do a great deal of statistical work for the Departments of Education, (including the University of Alberta), Industries and Labour, Lands and Forests, Public Welfare, Audit and the Alberta General Fire Insurance Company.

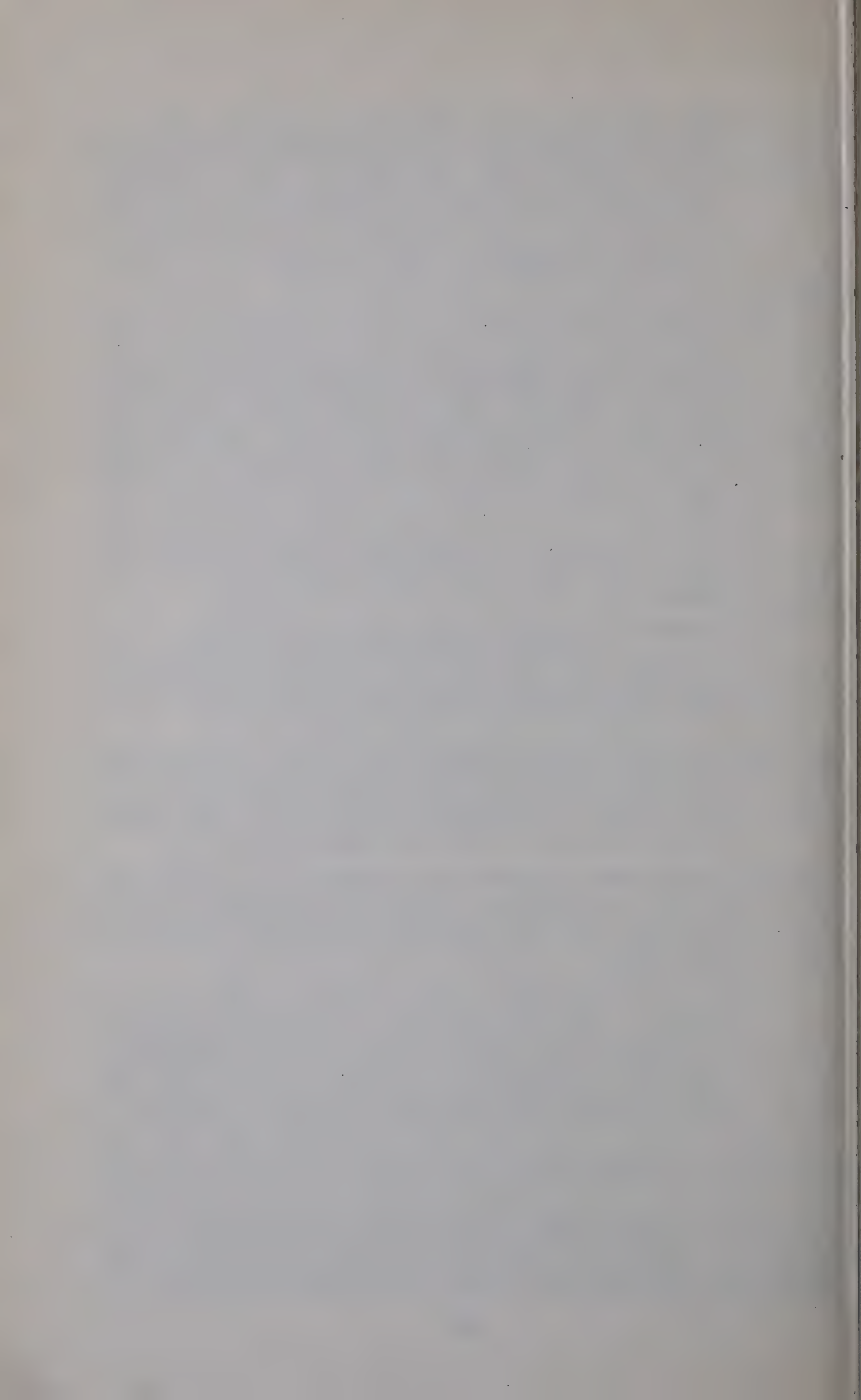
As provided by Provincial Act, various services are made available to the organized municipalities and the amount of direct intervention allowed the senior government in the affairs of these municipalities is limited to the bare essentials required for good government in the best interests of the people at large. Under the over-all direction of the Minister with the assistance of his Deputy Minister and a Provincial Co-ordinator of Civil Defence, the services offered at the present time by this department may be grouped as follows:

- (a) **Municipal Inspection Branch:** Annual inspections of the books and records of all towns, villages, counties and municipal districts. Particular attention is paid to their by-laws, budgets, methods of finance and the way they exercise their authority

under the various acts. A large percentage of this branch's time is spent in an advisory capacity to both local authorities and private individuals. The organization of new municipalities, changes in status and records regarding boundaries are looked after by this branch. It is also responsible for checking and compiling the audited financial statements of all municipalities into an Annual Statistical Report and the allotment of the grants provided by The Municipal Assistance Act.

- (b) **Assessment Branch:** To maintain a fair and equitable basis for taxation, this branch sets up the method and standard of assessment throughout the province. A staff of trained assessors under the supervision of the Director of Assessments, may upon request from local authorities undertake on an expense sharing basis the assessment of municipalities. In trust for the municipalities this branch collects and disburses the monies received under the terms of The Mobile Construction Equipment Licensing Act and The Seismographic and Drilling Equipment Licensing Act.
- (c) **The Alberta Assessment Commission** forms a final court of revision in appeals of various assessments. The Commission Chairman is responsible for the administration of The Communal Property Act.
- (d) **Tax Recovery Branch:** The Tax Recovery Act authorizes the sale of land for unpaid taxes. This branch supervises the enforcement of this Act and administers land acquired by the department under the Act. The Tax Recovery Officer in charge of this branch is also Personnel Officer for this department.
- (e) **Town and Rural Planning Branch:** This branch is the executive arm of the Provincial Planning Advisory Board and two of its chief functions are to provide technical assistance on town planning matters to municipalities requesting this service and to examine and approve all plans for the subdivision of land.
- (f) **Civil Defence:** The Civil Defence and Disaster Act passed in 1951 provides for civil defence and disaster planning and control throughout the province. In addition to the government staff there are at the present time some 29,200 citizens enrolled in civil defence.
- (g) **Board of Public Utility Commissioners:** Under the Minister of Municipal Affairs this Board forms an independent branch of the Department of Municipal Affairs. The chief responsibilities of the Board lie in regulating the rates charged by utility companies; protecting people from unwise investments and regulating the activities of local government in matters of finance.

Thus it can be seen that the future of this department is dependent on the growth of the province and future policies of the Provincial Government. Assuming that world conditions remain much the same and the province has attained a population in excess of 1,800,000 by the year 1985, it is anticipated that there will be steady growth in the department and by that time the staff will have increased from the present 293 to around 400 with a yearly appropriation in excess of \$2,000,000 as compared to the present \$1,200,000.



ALBERTA'S ECONOMIC PROSPECTS

MAIN AND SECONDARY HIGHWAYS AND LOCAL ROADS

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ALBERTA'S SYSTEM OF MAIN & SECONDARY HIGHWAYS DISTRICT AND LOCAL ROADS

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ALBERTA'S SYSTEM OF MAIN & SECONDARY HIGHWAYS: LOCAL & DISTRICT ROADS.

Summary

1. Development of the system of highways and roads dropped behind schedule during the depression period in the 1930's and as a result of the second world war. This deficit could be considered as almost balanced at this date, as a result of greatly increased construction programmes since 1945. The Main and Secondary Highway system increased from 3,907 miles in 1945 to 5,300 miles in 1955. This shows a rate of increase of more than twice that of the preceding ten year period.

More important, however, has been the advance into higher standard roads. Asphaltic surfaced highways, for example, increased from 521 miles in 1945 to 1,880 miles by 1955. The application of improved standards, together with the extension to the system in the past decade, could be considered as having placed the road systems in step with the times.

2. Standards being applied to the expanding system have been greatly advanced in all the stages of road building. In the past few years traffic densities have made it necessary to introduce four-lane standards on our main trunk highways. To March 31st, 1955 some 36 miles were complete, with a further 44 miles under construction. Parking shoulders have been introduced on two-lane highways. This feature was initiated for safety, to increase the overall capacity, and far from least to give added strength to the highways. This provision is being initiated on all main arterial highways, with much to be done on prior construction.

3. Much improvement has been seen in the Municipal Districts with a substantial number of miles having gravel surfaces. The absorption of some district roads into the secondary highway system has also aided in up grading the quality of their roads.

4. The introduction of the Trans-Canada Highway agreement in 1950 started the construction of approximately 282 miles of highway from the Saskatchewan border at Walsh to Banff Park. This highway is being financed jointly with the Federal government on an equal shared cost basis. To date approximately 215 miles have been completed except for finishing stages on 29 miles. Final completion of the Alberta section is expected within the next 2 to 3 years. This highway is a two-lane type with parking shoulders. The majority of Main Highways in the province are now being constructed to equal standards.

5. Expenditures made on roads and highways have been increased manifold in the past ten years. This is, of course, attributed to the vast expansion in the road system. However, the greater portion of the money spent can be attributed to the change to higher standards. Costs for Main Highways today range five to ten times the amount used fifteen years ago. With the introduction of multi-lane highways in main trunks, this differential is even higher. With intensified construction and the introduction of more safety features and other necessary items, the future will likely see a reduction in the number of miles constructed yearly.

In recent years grants from the province to municipalities have greatly increased, permitting the construction of better type roads for their use. Some district roads have been absorbed into the secondard highway system, somewhat easing their financial burden in developing higher standard roads.

Forecasted Prospects for the Highway and Road System

1. The Main and Secondary system to be extended from 5,300 at present to 6,700 miles by 1985. The rate of extension to the system somewhat lower than in the past, is expected due to requirements within the present system and the time and money elements for intensified construction for the future.

2. Paved highways to be increased from 1,880 miles in 1955 to 6,200 miles by 1985.

The overall rate to result in a high percentage of highways paved at the end of the 30-year period. The average rate is expected to be lower than in the past five years because of the amount of work, money and time required on multi-lane highways, wide two-lane highways and the periodic repaving required with passing time.

3. Increase in four-lane highways within the system from 36 miles in 1955 to 700 miles in 1985. Due to expected growth in population, motor car densities and commercial trucking, this estimate was made on anticipated requirement only. The largest portion is expected for a north-south trunk highway.

4. A continued increase in road work is expected in the municipalities; however, as has developed in the past few years, more provincial assistance will likely be the deciding factor for raising the standards of roads built. Further absorption of arterial local roads into the secondary system is forecasted, with the province constructing and financing a greater number of them directly. This could mean higher standard roads for the municipalities, without the additional cost burden.

5. Further joint Dominion-Provincial highway ventures are expected along the lines of the present Trans-Canada Highway. In particular with the emphasis on all-Canada travel routes, additional inter-provincial links will likely be made to serve a wider cross-section of the country and people.

With the expansion of military bases in the more remote areas and the need for future improvement to highways serving the far north, further Federal aid might be considered a continuing feature in the road picture.

6. A continued increase is expected in the expenditures for the provincial road system. This increase will be necessary to ensure adequate highways by strength, capacity, safety and for service to all areas. Costs will become increasingly higher with further development within the system and in extension to it. Maintenance costs will also increase in parallel with the expansion of the system. Preventative maintenance initiated to a greater degree will require increased commitments. The time element for intensified construction is expected to keep the yearly expenditures under restraint. The graphical presentation of Chart No. 1 shows the forecast of future expenditures.

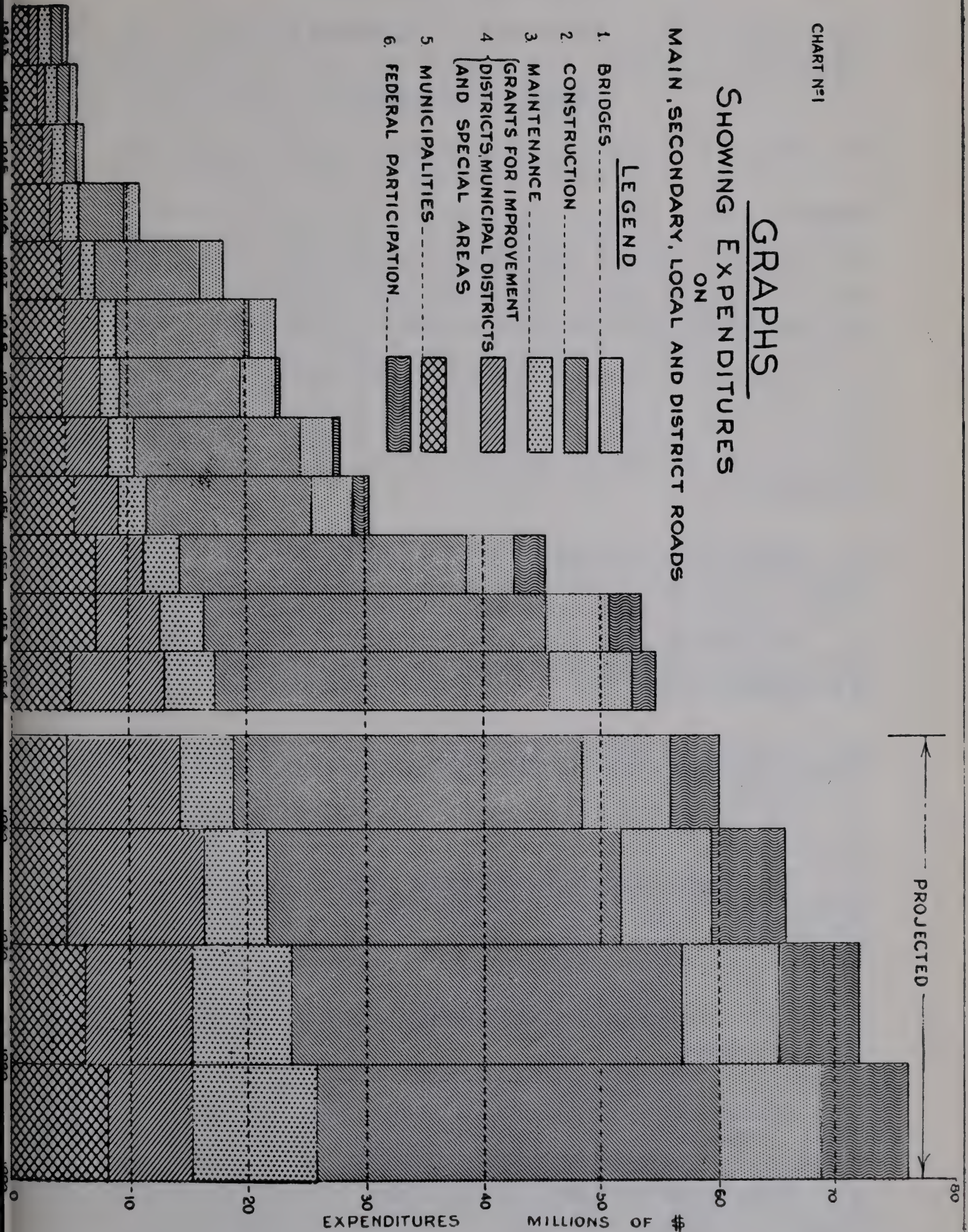
CHART N°1

GRAPHS SHOWING EXPENDITURES ON

MAIN, SECONDARY, LOCAL AND DISTRICT ROADS

LEGEND

- 1. BRIDGES
- 2. CONSTRUCTION
- 3. MAINTENANCE
- 4. GRANTS FOR IMPROVEMENT
DISTRICTS, MUNICIPAL DISTRICTS
AND SPECIAL AREAS
- 5. MUNICIPALITIES
- 6. FEDERAL PARTICIPATION



PROVINCE OF ALBERTA

ROADS & HIGHWAYS

General

The system of local and district roads, main and secondary highways with the necessary bridges and continuing maintenance of all is financed and administered jointly by the Provincial and Municipal governments.

The division of responsibility at the present time is as follows:

The Province:

1. Construction of all Main and Secondary highways with the necessary bridges.
2. Maintenance of all Main and Secondary highways and bridges common to both. In addition, the construction and maintenance of ferries falls in the same category.
3. Provincial grants are made for the construction and maintenance of local and district roads in Municipalities and special areas.
4. The province constructs roads in Special Areas contributing 100%.
5. The construction of Trans-Canada Highway is carried out by the province and financed jointly with the Federal government on an equal cost basis.

The Municipalities

1. Construction and maintenance of local and district roads with provincial assistance.
2. Maintenance of roads in Special Areas.

EXPENDITURES FOR MAIN AND SECONDARY HIGHWAYS DISTRICT AND LOCAL ROADS

The construction of systems of highways and roads, being a public work, is sensitive to fluctuations in the general economy of the province. The result of depression and war reduces and almost curtails construction programmes through these periods of emergency.

Maintenance of these facilities of necessity continues and with any extension of subnormal times, is subject to increase.

Chart No. 1 in the form of a bar graph shows the trends in construction of all roads and bridges and the maintenance of same. The period from 1943 to March 31st, 1955 shows the overall trends as well as the distribution of expenditures made.

The picture presented tends to confirm the previous statement on the effect of war on the construction of highways. A similar recession in construction programmes took place through the depression years, indicating the sensitivity of a public work to changes in the economy. The close sequence of these restrictive periods, therefore, resulted in a lag in the building up of the road system. During this same period the population and motor vehicle densities were not effected to the same degree, thus highway requirements fell behind.

The trend in road construction following the war took a decided upsurge, required as a result of the preceding lag, demanded by the marked increase in highway use and permitted as a result of the return to prosperity through expanding industry, agriculture and in particular, the oil discoveries.

The rate of this upsurge in road construction could be considered as being extreme.

The bar graph Chart No. 1 shows the extent of the increase in expenditures for the period from 1943 to 1955, giving in addition the breakdown and distribution over the Provincial and Municipal systems.

In both the Provincial and Municipal fields a very marked increase has taken place in expenditures for roads. It is apparent, however, that construction on Main and Secondary Highways has seen the greatest expansion showing its flexibility witht the changing economy. The initiating of the Trans-Canada Highway agreement has added to the total expenditures for construction of Main Highways. The chart sets out separately the portion of the expenditure made by the Federal Government. The province portion for Trans-Canada Highway is included in the graph under bridges and construction.

Expenditures for work in Municipalities, Special Areas and Improvement districts has increased, however, at a much lower rate. This trend follows a more normal development and dictates a lesser sensitivity to the changing economy of the province in general. In other words the effect of prosperity and recession has not resulted in radical changes in the municipal districts. For this reason provincial grants made for road work in these districts has been increased to aid the municipalities to approach a parallel with the advancing development.

As stated previously the rapid advance in road development following the war was as a result of, and made possible by the following:

1. The need to correct the lag in prior development, a direct result of the recession period during the depression years, and during the war emergency period.
2. Increased densities of motor vehicles effected to a lesser degree during the restricted periods. Exceptional increase followed the war, in line with the general trend in industrial development.
3. Extensive and rapid economic growth through development of industry, agriculture and in particular the oil and gas resources. This expansion demanded increased road development supplying in return the necessary funds.

Future Expenditures

A continued increase in overall expenditures is anticipated at a somewhat reduced rate. Considering the next 30-year period broken down into 10-year intervals, an average uniform increase, as shown graphically on Chart No. 1, is expected. By using 10-year intervals for the overall view, minor recession and upsurge action will be modulated paralleling to a degree the expectations for population growth and trends in vehicle densities.

The rate of increase in expenditure may be expected to reduce from the present due to a stabilizing in the economic picture, including control of inflation. Also the backlog of underdevelopment, resulting from the recession periods, may be considered as equalized.

The extension of the system will of certainty continue but, following the trend previously described, will likely reduce in rate. It must be remembered, however, that considerable improvement and development will take place within the system, for which large amounts of money will be required. Costs involved in this development within the system are high and point to a general intensification in the road construction field. This in itself indicates a lowering in the rate of extending the system.

Summary of Future Expenditures

The trend of expenditures in municipalities is on a gradual increase. However, in recent years a large percentage of the money used on these local roads has been made up of grants from the Provincial Government. It appears to be a possibility that in the future these grants will be steadily increased. However, a trend of absorbing district highways into the secondary provincial system is developing in specific cases. It is, therefore, a calculated possibility that further definite absorption of arterial market roads into the secondary system will be made. The graphical representation on Chart No. 1 is a forecast of this theory. This does not mean that less money will be expended in the municipalities but that the provincial government, instead of supplying grants with limited supervision, may directly construct and develop arterial roads in the municipal districts.

Maintenance expenditures of necessity are expected to show a marked increase with the extension and intensifying of the road networks. Preventative maintenance initiated to a greater degree will require increased commitments. The trend in this phase is expected to be at an increasing rate.

Construction of Main and Secondary highways and bridges is expected to increase, however at a rate less than the past decade. The amount over 10-year intervals is expected to have a uniform increasing rate. With the emphasis being placed on interprovincial, and on all-Canada routes, Federal contribution might be considered a continuing feature, following the lines of the present Trans-Canada Highway agreement.

If however, this is not forthcoming, the Provincial expenditure forecast may be considered at the level of the top most points on the graph of Chart No. 1.

STATUS OF ROADS & HIGHWAYS TO MARCH 31, 1955

PROVINCIAL STATISTICS

	Earth Miles	Graded Miles	Gravelled Miles	Asphaltic Surfaced Miles	Totals Miles
Main Highways	53.46	5.49	1,454.74	1,681.43	3,195.12
Secondary Highways	23.53	14.08	1,870.00	197.85	2,105.46
District and Local Roads.....	28,542.70	26,441.55	24,628.80	27.70	79,640.75
Totals	28,619.69	26,461.12	27,953.54	1,906.98	84,941.33

The above totals represent mileage of highways and roads constructed and requiring maintenance control.

Table No. 1 pertaining to Main and Secondary Highways shows their status for a period from 1936 to 1955. A trend which may be seen in this chart is directed to a rapid change from the unimproved road allowance to graded roads. The most predominant shift however, follows the graded stage, where large portions of road systems are being gravelled, to give a better all weather traffic surface. This in general applies to district and local roads.

On the Main and Secondary Highway system the shift advances into the higher standards, from gravel surface to asphaltic pavements. Since 1951 the overall mileage of gravelled routes in the Main and Secondary highway system has decreased. However, asphaltic surfacing has advanced in an amount exceeding the extension of the total miles in the system.

The policy bringing the backlog of highways up to paved standards will continue to dominate this trend for some time.

Modern basic construction standards enable a close follow-up with final paving operations. This procedure reduces the delay in reaching the final stage for any extension to the system.

The past trends in highway development, although somewhat erratic, definitely show great progress towards high standard roads. Further extensive improvement within the system will have to be made, particularly between the major centres.

The problem of congestion on highways in the province today is becoming more evident. The rapid growth in population, and in highway users has posed this problem. As this congestion problem has shown up on our old established routes, the assumption that greater capacities within the system will be required appears sound. This may be considered a major undertaking for the future.

The growth of the Main and Secondary Highway system from 1936 to 1955 is shown on Chart No. 2.

The rate of growth was moderate following the depression years until the war emergency period, where progress was practically at a standstill. Following the war, an abrupt upsurge in extension to the system took place. The need for more and better highways to satisfy the rapid development of the province dictated this trend. The rate of this building was further increased to reduce the backlog which had previously developed.

Further extension at slower rate is expected for the future. The reasons for the reduced rate forecast are as follows:

1. The backlog of work resulting from past restrictive periods might be considered as brought up to date.
2. Portions of the existing system will require conversion into multilane type highways to satisfy the need for increased capacities. This work in itself will take large amounts of money and time. Table 3 sets out estimated costs per mile for the various widths of highway to modern high standards.
3. Construction standards and methods having become more intensified and costly, will reduce the rate of extension in miles to the system. This has been a gradual trend developing over the preceding years.

The future forecast for the extension of the Main and Secondary highway network was made, due regard being paid to the foregoing.

It might be added at this point that absorption of a portion of the arterial, local and district roads into the secondary system is a considered possibility.

Further development of Trans-Canada Highway routes along the lines of the system under construction may be considered a distinct possibility. Roads will be required to service military bases and installations, which are being expanded in the province. It is also expected that improved roads will be required to service the far north where great advances in development appear certain. These roads, of course, would be of great importance to Canada. It could be predicted then that Federal participation would be necessitated by such work.

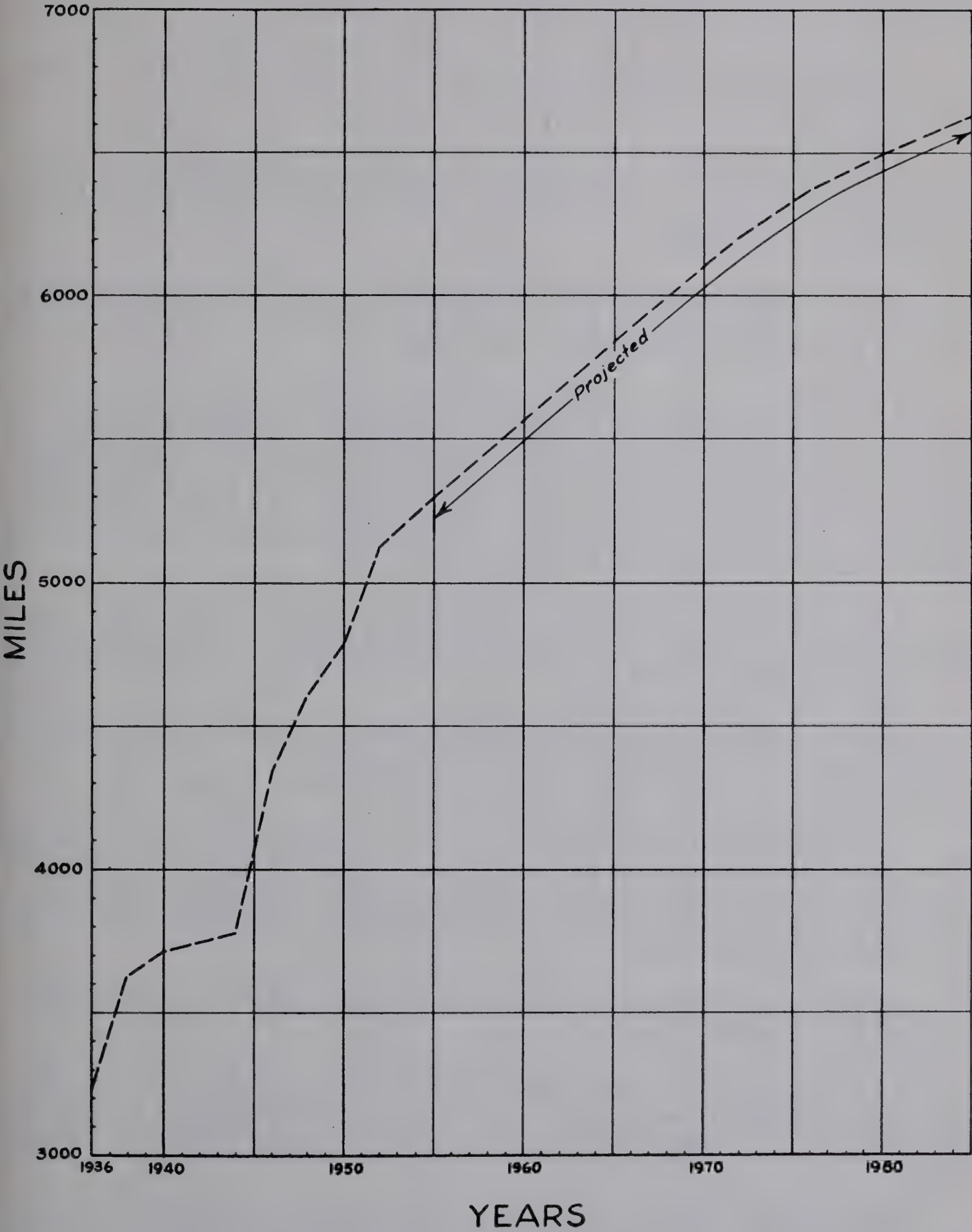
TABLE No. 1
PROVINCE OF ALBERTA
Department of Highways
MILES OF MAIN AND SECONDARY HIGHWAYS
FROM MARCH 31, 1936 to MARCH 31, 1951

Date		Earth	Graded	Gravelled	Asphalt	Totals
March 31, 1936	Main and Secondary Highways	207.83	767.49	2,152.08	92.55	3,219.95
March 31, 1937	Main and Secondary Highways	181.08	765.72	2,160.78	145.99	3,253.57
March 31, 1938	Main Highways	429.08	624.34	1,731.19	247.72	3,032.33
	Secondary Highways		113.49	465.92		579.41
	TOTALS	429.08	737.83	2,197.11	247.72	3,611.74
March 31, 1939	Main Highways	428.53	625.11	1,594.72	281.41	3,029.77
	Secondary Highways		98.48	494.24		592.72
	TOTALS	428.53	723.59	2,088.96	381.41	3,622.49
March 31, 1940	Main and Secondary Highways	498.21	674.16	2,065.43	483.50	3,721.30
March 31, 1941	Main and Secondary Highways	474.33	688.16	2,086.02	484.41	3,732.92
March 31, 1942	Main and Secondary Highways	457.95	616.74	2,136.88	531.37	3,742.94
March 31, 1943	Main and Secondary Highways	466.67	555.93	2,221.50	531.75	3,775.85
March 31, 1944	Main and Secondary Highways	438.36	328.48	2,376.16	531.29	3,774.29
March 31, 1945	Main Highways	317.88	231.30	1,948.27	521.38	3,018.83
	Secondary Highways	59.19	44.91	784.23		888.33
	TOTALS	377.07	276.21	2,732.50	521.38	3,907.16
March 31, 1946	Main Highways	309.80	261.93	1,907.75	531.06	3,010.54
	Secondary Highways	479.90	25.67	825.03		1,330.60
	TOTALS	789.70	287.60	2,732.78	531.06	4,341.14
March 31, 1947	Main Highways	263.43	174.38	2,031.75	531.09	3,000.65
	Secondary Highways	391.69	209.86	958.95		1,560.50
	TOTALS	655.12	384.24	2,990.70	531.09	4,561.15
March 31, 1948	Main Highways	190.12	112.72	2,052.54	645.61	3,000.99
	Secondary Highways	287.28	108.01	1,213.51		1,608.80
	TOTALS	477.40	220.73	3,266.05	645.61	4,609.79

TABLE No. 1 (Continued)

Date		Earth	Graded	Gravelled	Asphalt	Totals
March 31, 1949	Main Highways	173.65	27.18	2,098.66	689.82	2,989.31
	Secondary Highways	160.87	30.30	1,569.36	2.57	1,763.10
	TOTALS	334.52	57.48	3,668.02	692.39	4,752.41
March 31, 1950	Main Highways	112.05	34.59	2,157.08	779.15	3,082.87
	Secondary Highways	127.58	48.45	1,516.21	14.28	1,706.52
	TOTALS	239.63	83.04	3,673.29	793.43	4,789.39
March 31, 1951	Main Highways	54.88	3.06	2,078.59	982.07	3,118.60
	Secondary Highways	120.34	22.67	1,680.61	56.88	1,880.50
	TOTALS	175.22	25.73	3,759.20	1,038.95	4,999.10
March 31, 1952	Main Highways	53.46		1,972.15	1,091.38	3,116.99
	Secondary Highways	135.34	47.91	1,746.88	75.01	2,005.18
	TOTALS	188.80	47.91	3,719.03	1,166.39	4,122.17
March 31, 1953	Main Highways	53.56		1,657.77	1,406.96	3,118.19
	Secondary Highways	57.09	56.82	1,844.80	91.91	2,050.62
	TOTALS	110.55	56.82	3,502.57	1,498.87	5,169.81
March 31, 1954	Main Highways	53.46		1,568.76	1,549.42	3,171.64
	Secondary Highways	40.61		1,883.84	141.83	2,066.28
	TOTALS	94.07		3,452.60	1,691.25	5,237.92
March 31, 1955	Main Highways	53.46	5.49	1,454.74	1,692.86	3,206.51
	Secondary Highways	23.53	14.08	1,870.00	186.42	2,094.03
	TOTALS	76.99	19.57	3,324.74	1,879.28	5,300.58

MILES IN MAIN HIGHWAY & SECONDARY
HIGHWAY SYSTEM



MOTOR VEHICLE DENSITIES

Prior to the end of the Second World War, the rate of increase in automobile licensing was fairly uniform, paralleling the economic stature of the province during that period (See Chart No. 3, Table No. 2).

Following the war a marked increase in the number of automobiles using the highways took place following again the trend in prosperity, together with some inflationary action.

It may also be noted that the highway network underwent a similar expansion during that period of time.

In 1940 the ratio of population to licensed automobiles in the province was approximately 9 : 1. This period followed the depression years recovery, and extended into the early part of the war, so may be considered as average for that time.

As of 1955 the population has increased to 1,066,000 and automobile licensing to 240,000. The ratio, therefore, has changed to approximately 9 : 2, or a doubling of car owners per capita.

With the further development of the province into new areas, extension of city residential areas into the suburbs, a continued increase in automobile owners is inevitable. The rate of increase of car owners following the trend of the past will in all likelihood exceed the rate of population growth. This can be expected, due to the suburban and district expansion which is taking place. Advancement in the general standards of living will most certainly mean more cars per capita.

The trend in commercial trucking since 1920 has been much more sensitive to rise and fall of the economic structure than the passenger cars. Table No. 2 shows the effect of the depression and the war years' slump.

Following the war, a very rapid expansion took place in the industry which is expected to continue into the future. The rate of increase is expected to stabilize in a slightly lower position than at present.

Although farm modernization has to a degree been stabilized by this time, a uniform rate of increase in the number of farm trucks is also expected. The development of more of the fringe areas for agriculture and resultant lengthening of market roads practically dictates an increase in the number of farm trucks.

Conversely then, the development of more higher standard market roads will be the likely result.

On completion of the Trans-Canada Highway underway at present, more interprovincial traffic will certainly be seen. Commercial transportation, servicing and passing through Alberta is expected to take a definite climb.

With the accent being placed on all-Canada routes, the trend will likely be towards a decided increase in road users over and above those registered in the province.

CHART № 3

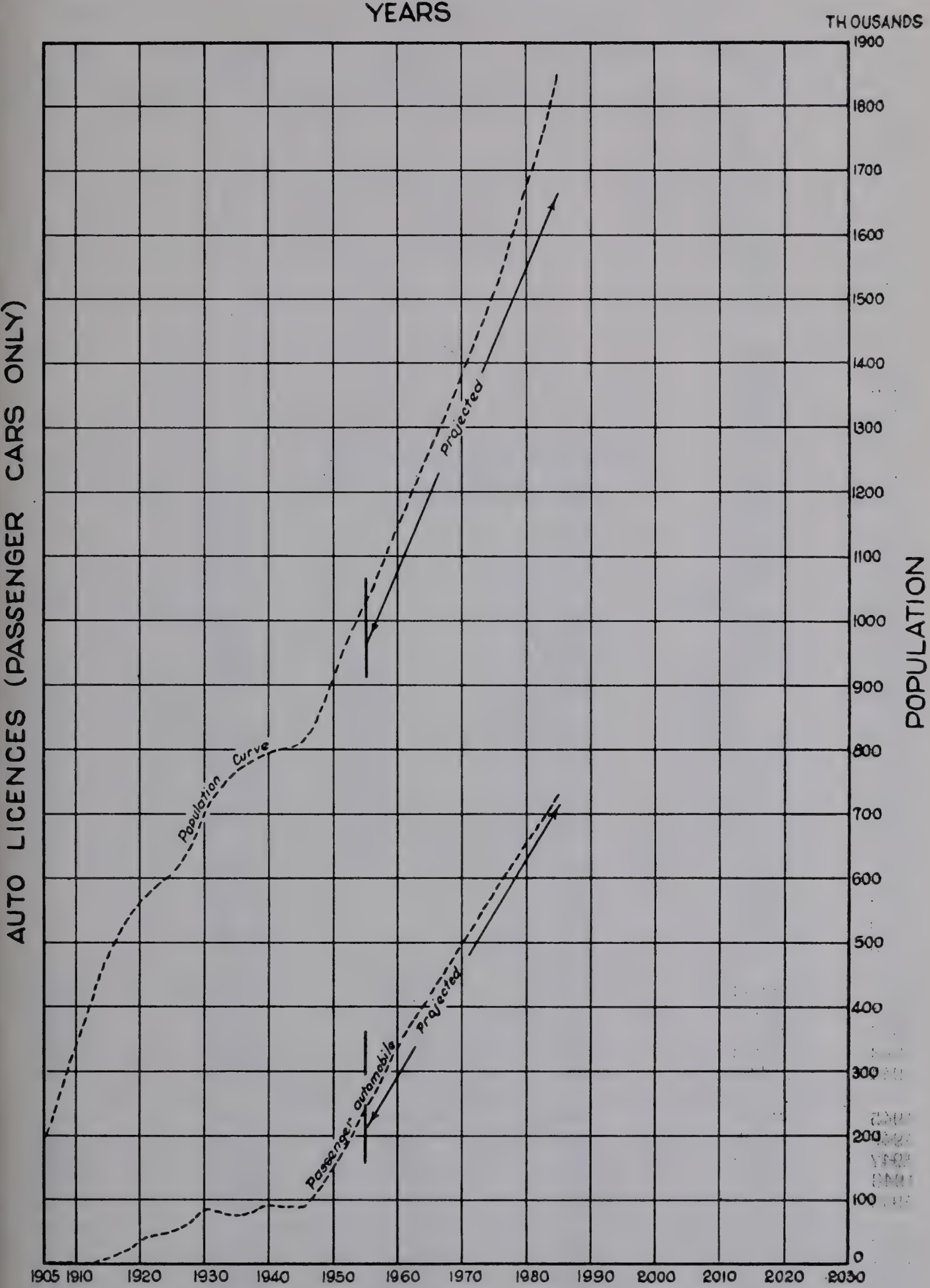


TABLE No. 2
MOTOR VEHICLE LICENSES
1906 to 1954, Inclusive

Year	Passenger Cars	Motorcycles	Public Service Vehicles	Commercial Vehicles	Farm Vehicles
1906	41				
1907	45				
1908	55				
1909	275				
1910	423				
1911	1,613				
1912	2,502				
1913	3,733				
1914	4,728				
1915	5,832				
1916	9,707				
1917	20,624				
1918	29,250				
1919	34,000				
1920	36,575	1921 to 1939. No breakdown. Totals only shown.			
1921	38,165	440		1,687	
1922	38,124	403		1,749	
1923	39,742	390		2,191	
1924	45,871	331		2,036	
1925	50,496	362		3,138	
1926	59,767	No record		4,362	
1927	67,665	No record		6,641	
1928	78,302	346		8,919	
1929	85,087	390		12,482	
1930	85,067	447		15,068	
1931	78,782	383		15,034	
1932	71,717	409		14,293	
1933	71,076	467		14,174	
1934	73,114	469		15,383	
1935	76,562	380		16,353	
1936	79,185	529		17,310	
1937	81,365	547		18,080	
1938	84,958	605		21,221	
1939	88,270	674		24,369	
1940	92,553	715	5,542	6,517	15,982
1941	95,921	741	5,465	7,334	16,996
1942	92,738	890	4,941	8,332	18,857
1943	92,238	885	5,451	8,911	20,070
1944	91,500	912	5,807	9,339	21,260
1945	87,308	760	6,609	9,345	21,862
1946	95,058	994	8,140	11,404	23,624
1947	104,350	1,534	9,481	14,846	25,984
1948	114,676	1,814	10,074	18,300	29,872
1949	130,155	2,260	10,361	23,108	35,408
1950	150,719	2,549	10,574	24,696	44,176
1951	166,568	2,508	11,188	29,091	50,738
1952	188,228	2,369	11,855	34,958	55,280
1953	206,358	2,306	11,855	40,080	59,433
1954	221,289	1,853	11,754	43,570	61,462

TABLE No. 2 (Continued)
MOTOR VEHICLE LICENSES
Estimate 1955 - 1985

Year	Passenger Cars	Motorcycles	Public Service Vehicles	Commercial Vehicles	Farm Vehicles
1955	240,000	1,800	12,000	46,000	63,000
1960	340,000	2,000	12,500	52,000	66,000
1965	420,000	2,000	13,000	60,000	70,000
1970	500,000	2,000	13,500	65,000	73,000
1975	575,000	2,000	14,000	70,000	76,000
1980	660,000	2,000	14,500	75,000	79,000
1985	730,000	2,000	15,000	80,000	82,000

TABLE No. 3

ESTIMATED CONSTRUCTION COSTS

PROVINCE OF ALBERTA

COST OF CONSTRUCTION, MATERIALS, ENGINEERING AND MISCELLANEOUS (ROYALTIES, ETC.)

Subgrade Widths	26'	36'	50'	70' to 74'	98'
Grading Costs					
Normal Prairie Regions	\$ 16,000.00	\$ 22,000.00	\$ 29,800.00	\$ 42,000.00	\$ 66,000.00
Dry Prairie Regions	14,500.00	20,500.00	28,300.00	38,000.00	52,000.00
Bush Regions	17,500.00	24,000.00	32,600.00	46,000.00	76,000.00
Muskeg Regions	20,000.00	34,500.00	49,800.00	69,000.00	98,000.00
First Course Gravelling					
Normal Conditions	\$ 2,000.00	\$ 2,500.00	\$ 3,800.00	\$ 3,800.00	\$ 3,800.00
Long Haul Regions	2,500.00	3,200.00	4,800.00	4,800.00	4,800.00
Train Haul Regions	2,800.00	3,700.00	5,400.00	5,400.00	5,400.00
Stabilized Gravel Base Course					
Normal Conditions	\$ 22,000.00	\$ 26,000.00	\$ 38,500.00	\$ 54,000.00	\$ 75,000.00
Long Haul Conditions	27,000.00	32,000.00	46,000.00	64,000.00	89,000.00
Train Haul Conditions (Extreme)	28,000.00	33,400.00	47,700.00	67,000.00	93,000.00
Asphaltic Plant Mix Surface Course					
Normal Conditions	\$ 20,000.00	\$ 20,600.00	\$ 22,000.00	\$ 35,000.00	\$ 52,000.00
18% Increase	23,600.00	24,300.00	25,900.00		
Long Haul Condition	22,500.00	23,200.00	24,500.00		
18% Increase	26,500.00	27,400.00	28,950.00	38,500.00	57,000.00
Train Haul (Average)	25,100.00	25,900.00	27,000.00		
18% Increase	29,600.00	30,600.00	31,900.00	43,500.00	63,800.00
Extreme Conditions	27,200.00	27,900.00	29,000.00		
(Haul Over 18 Miles)	32,100.00	32,950.00	34,250.00	46,400.00	68,500.00
Asphaltic Seal Coat					
Normal Conditions	\$ 3,200.00	\$ 3,200.00	\$ 3,200.00	\$ 6,400.00	\$ 6,400.00
Long Haul Conditions	3,600.00	3,600.00	3,600.00	7,200.00	7,200.00
Train Haul Average	3,700.00	3,700.00	3,700.00	7,400.00	7,400.00
Extreme Conditions	4,000.00	4,000.00	4,000.00	8,000.00	8,000.00
Average Highway Complete	\$ 67,000.00	\$ 82,000.00	\$105,000.00	\$146,000.00	\$198,000.00

Table 1. POPULATION AND NATURAL INCREASE — ALBERTA, 1905 - 1955

Year	Population (estimated)	Actual Increase over previous year	Natural Increase	Rate of Natural Increase %
1906	185,000		1,912	1.3
1907	236,000	51,000	3,154	1.3
1908	266,000	30,000	3,785	1.4
1909	301,000	35,000	4,235	1.4
1910	336,000	35,000	4,795	1.4
1911	374,000	38,000	5,195	1.4
1912	400,000	26,000	6,052	1.5
1913	429,000	29,000	7,439	1.7
1914	459,000	30,000	9,268	2.0
1915	480,000	21,000	9,864	2.1
1916	496,000	16,000	9,273	1.9
1917	508,000	12,000	9,529	1.9
1918	522,000	14,000	6,966	1.3
1919	541,000	19,000	8,623	1.6
1920	565,000	24,000	10,890	1.9
1921	588,000	23,000	11,621	2.0
1922	592,000	4,000	10,899	1.8
1923	593,000	1,000	10,054	1.7
1924	597,000	4,000	9,739	1.6
1925	602,000	5,000	10,227	1.7
1926	608,000	6,000	9,297	1.5
1927	633,000	25,000	9,838	1.6
1928	658,000	25,000	9,993	1.5
1929	684,000	26,000	10,685	1.6
1930	708,000	24,000	12,153	1.7
1931	732,000	24,000	11,950	1.6
1932	740,000	8,000	11,469	1.5
1933	750,000	10,000	10,777	1.4
1934	758,000	8,000	10,899	1.4
1935	765,000	7,000	10,454	1.4
1936	773,000	8,000	9,639	1.2
1937	776,000	3,000	9,642	1.2
1938	781,000	5,000	10,020	1.3
1939	786,000	5,000	10,681	1.4
1940	790,000	4,000	11,156	1.4
1941	796,000	6,000	10,923	1.4
1942	776,000	— 20,000	12,226	1.6
1943	785,000	9,000	12,766	1.6
1944	808,000	23,000	13,052	1.6
1945	808,000		13,485	1.7
1946	803,000	— 5,000	15,583	1.9
1947	825,000	22,000	18,088	2.2
1948	854,000	29,000	17,088	2.0
1949	885,000	31,000	17,852	2.0
1950	913,000	28,000	18,769	2.1
1951	939,000	26,000	19,836	2.1
1952	970,000	31,000	21,760	2.2
1953	1,002,000	32,000	23,539	2.3
1954	1,039,000	37,000	26,384	2.5
1955	1,066,000	27,000		

Table 2. POPULATION PROJECTION — ALBERTA, 1951 - 1985

(1951 Base Year and Population 939,501)

Year	Birth Rate (per 1,000)	Death Rate (per 1,000)	Natural Increase (per 1,000)	Population neglecting immigration & emigration
1951	28.8	7.6	21.2	939,500
1952	30.1	7.6	22.4	959,400
1953	31.3	7.8	23.5	980,900
1954	32	8	24	1,004,000
1955	31	8	23	1,028,000
1956	29	8	21	1,052,000
1957	29	8	21	1,074,000
1958	29	8	21	1,096,000
1959	29	8	21	1,119,000
1960	29	8	21	1,143,000
1961	27	9	18	1,167,000
1962	27	9	18	1,188,000
1963	27	9	18	1,209,000
1964	27	9	18	1,231,000
1965	27	9	18	1,253,000
1966	28	9	19	1,276,000
1967	28	9	19	1,300,000
1968	28	9	19	1,325,000
1969	28	9	19	1,350,000
1970	28	9	19	1,376,000
1971	29	9	20	1,402,000
1972	29	9	20	1,430,000
1973	29	9	20	1,458,000
1974	29	9	20	1,487,000
1975	29	9	20	1,517,000
1976	29	9	20	1,547,000
1977	29	9	20	1,578,000
1978	29	9	20	1,610,000
1979	29	9	20	1,642,000
1980	29	9	20	1,675,000
1981	29	9	20	1,709,000
1982	29	9	20	1,743,000
1983	29	9	20	1,778,000
1984	29	9	20	1,814,000
1985	29	9	20	1,850,000

ALBERTA'S ECONOMIC PROSPECTS

Prepared by:

DEPARTMENT OF PUBLIC HEALTH

Department of Public Health

HON. W. W. CROSS, M.D.
Minister

A. SOMERVILLE, M.D., D.P.H.
Deputy Minister

ALBERTA'S ECONOMIC PROSPECTS

Department of Public Health

Hon. W. W. Cross, M.D., Minister

A. Somerville, M.D., D.P.H., Deputy Minister

H. E. Homan, Assistant Deputy Minister (and Sec'y - Acc't.)

M. G. McCallum, M.D., Hospitals Division

R. R. MacLean, M.D., Mental Health Division



Context of Report

1. Summary
2. Local Public Health Services
3. Medical — Dental — Nursing Services
4. Mental Health Services
5. Public General Hospitals

SUMMARY

H. E. Homan, Assistant Deputy Minister (and Sec'y. - Acc't.)

GENERAL

In an endeavor to be as brief and concise as possible, this report, looking ahead from the present for a 30-year period, has only set out four special sections, which are considered to be of the most consequence with respect to protecting or caring for the public health needs of the people of the Province of Alberta.

Many services that are in operation, such as tuberculosis control and hospitalization, over-all communicable disease control, sanitary engineering control (sanitation, plumbing, water, sewerage disposal, stream pollution, air pollution), social hygiene control, public health laboratories, cancer diagnostic and treatment services, cerebral palsy and arthritic clinic services, and other forms of public health programs, or assistance, will probably increase in orderly fashion in direct relation to population.

A projection of the cost of maintaining the present Department of Public Health services, based on actual expenditures for the fiscal year 1954/55 of \$20,210,000.00, or \$20.13 per capita, would indicate that in 1985 the Department expenditures would approximate \$37,240,000.00 or an increase in the 30-year period of approximately a further \$17,000,000.00.

To service this growth, approximately 1,000 more employees would be required.

However, certain fiscal policies which are being discussed at Provincial and Federal level, in the fields of hospitalization insurance, medical insurance, or a complete health insurance program, would be a major factor, if implemented, in considerably increasing the projection of expenditures and, as present day trends of thought are along these lines, additional expenditures should, in all likelihood, be contemplated.

LOCAL PUBLIC HEALTH SERVICES

The present program of Local Health Services, consisting of City Health Departments, Health Units and Municipal Nursing Centres, is providing reasonably adequate public health protection, with only three major areas needing a Health Unit on behalf of approximately 75,000 people to complete the program. The further development of the program would likely be in direct relationship to increase in population.

MEDICAL — DENTAL — NURSING SERVICES

The ratio of medical practitioners in Alberta of one doctor per 1,000 population is very good in comparison with the Canadian averages. The distribution between urban and rural areas is, perhaps, not equitable but, with the possible advent of further hospital or medical insurance programs that would guarantee income in the rural areas, this will probably adjust itself. Also, it is thought that the supply of medical practitioners would increase in proportion to population.

The ratio of dental practitioners in Alberta is in relationship with the Canadian average but it is considered that the over-all averages are too low, as the field of preventive dentistry is just starting to develop and, therefore, the present ratio should, perhaps, be doubled in the next few

years. This increase together with possible fluoridation programs to communal water supplies, would probably provide adequate services. To provide the additional dentists required in the foreseeable future, it would appear that additional dental schools in Western Canada should be established.

Nursing services in the last year or so has improved materially. The demand for this service during the past ten years has increased more rapidly than in relationship to the general population and it is thought this trend would continue for a few more years, with the possible coming of further health insurance programs, before levelling out.

MENTAL HEALTH SERVICES

Mental health services, including mental hospital facilities, will probably increase at a little higher rate than population increases, but, using an average between present ratios and suggested standard ratios, it would appear that 3,600 additional mental hospital beds will have been required by 1985 and, at an estimated average cost of \$6,000.00 per bed, a total expenditure during the next 30 years would approximate \$21,600,000.00.

Institutions for the care of mental defectives will probably require a further 1,500 beds by 1985 and, at an estimated cost of \$6,000.00 per bed, a further \$9,000,000.00 expenditure will be required during the next 30 years.

Mental Health Guidance Clinics will probably require expansion at a rate somewhat larger than the ratio to population increases and a further expenditure, during the next 30 years, of approximately \$1,000,000.00 would be indicated.

Employment opportunities in the mental health field alone, during the next 30 years, would probably increase by about 800 employees.

PUBLIC GENERAL HOSPITALS

The facilities in Alberta in this field appear to be very good in comparison with Canadian averages being 6.3 beds per 1,000 population in 1954. Approximately 560 more general hospital beds are required at present and this would provide a desired ratio of 6.8 beds per 1,000 population. This ratio, projected to the estimated population for 1985, would indicate that, during the next 30 years, a further 4,480 beds would be required and, at an estimated cost of \$12,000.00 per bed, the expenditure would approximate \$54,000,000.00.

In addition to acute hospital beds, a further requirement, to care for the chronic or long-term and incurable cases, in the nature of chronic hospital beds is indicated. Based on suggested national averages, which have yet to be met, of 1.5 beds per 1,000 population, further construction, in the next 30 years, in this field would approximate 2,400 additional beds at an estimated cost of \$6,000.00 per bed, representing an expenditure of \$14,400,000.00.

The estimated combined costs for active and chronic hospital bed expenditure, during the next 30 years, approximates \$68,400,000.00.

The utilization in hospital days projected to 1985, would increase from the present total for acute and chronic hospitals of 1,951,300 to 4,085,100 and the cost of providing service for this number of days would increase

from \$25,056,000.00 to \$49,748,000.00; employees would increase from 12,700 to 22,000 and employees' salaries from \$20,669,000.00 to \$37,499,000.00.

Based on present Provincial Government fiscal policies, the contribution towards the cost of providing the above referred to active and chronic hospital beds, at \$750.00 grant per active bed and \$1,500.00 grant per chronic bed, would represent an estimated Provincial expenditure, over the next 30 years, of \$6,960,000.00.

Present Provincial Government fiscal policies based on full utilization would contribute to the extent of approximately 70% of a standard ward hospitalization costs in the Province and this, projected to 1985 would mean an increase from \$14,500,000.00, at the present time, to \$34,800,000.00, or an increase of \$20,300,000.00.

LOCAL PUBLIC HEALTH SERVICES

A. Somerville, M.D., D.P.H. — Deputy Minister

For the purpose of this summary public health may be defined as the preventive program as typified in the local health services of the rural health units and the city health departments.

At the moment a standard program is in effect in the whole province except three areas where rural health units are still to be established. The outlying areas are covered mainly by Municipal Nurses although a small amount of this area, accounting for about 30,000 population, has no public health coverage.

With the establishment of three new health units the local health service of Alberta will be adequately covered. Further extensions would be proportional to increasing population.

The service can be tabulated as follows for 1954:—

	Population	Cost	Doctors	Nurses	San'y Insp.	Dentists	Other
Edmonton	195,000	\$ 243,466	3½	29	10	1½	11
Calgary	156,750	259,253	4	25	11	5	10
Lethbridge	26,000	29,000	1	3	2	-----	-----
Rural Units	488,872	700,706	16	64	20½	½	23
Municipal Nurses	32,000	208,500	-----	32	-----	-----	-----
Totals	898,622	\$1,440,925	24½	153	43½	7	44
Three new units to be formed	75,000	120,000	3	6	3	-----	3

MEDICAL — DENTAL — NURSING SERVICES

A. Somerville, M.D., D.P.H., Deputy Minister

MEDICAL

At the present moment the number of doctors in Alberta is almost exactly 1,000 or one medical doctor per thousand population. The Canadian average in 1954 was one doctor for 971 persons. The Alberta figure might be regarded as adequate except that the distribution is very bad. Our smaller

communities and more isolated areas are practically without medical service. In 1954, 673 of Alberta's doctors were located in communities of 10,000 or over with a total population of 351,491 or one doctor for every 522 persons. Of course, these doctors gave service to persons living outside the city but the rural-urban discrepancy is still large. A recent check has also shown that 30% of these doctors are specialists, which can be regarded as abnormally high. Over the years, the amount of work to be done by doctors has increased, but improved transportation and the collection of patients in hospitals has increased his effectiveness.

Alberta Doctors by Type of Practice—1954

	Alberta	Canada
General Private Practice	46%	43%
Specialists Private Practice	29%	29%
Other	25%	28%
	100%	100%

Age of Alberta Medical Doctors—1954

	Alberta	Canada
Under 35 years	27.7%	27.1%
35 to 44 years	35.6%	28.6%
45 to 54 years	18.2%	21.0%
55 to 64 years	8.6%	13.4%
Over 65 years	8.6%	9.0%
Not recorded	1.2%	0.8%

The need for medical service should increase pro rata with the population. There is no evidence that improving service in prevention or treatment will materially reduce the amount of work to be done by the practitioner.

Medical Insurance is spreading steadily across the world and it can be assumed that this will increasingly be true in Alberta. It can be anticipated that a scheme of full medical insurance would tend to give a better distribution of doctors throughout the province.

Alberta has operated a medical school for many years which has produced more than enough doctors for its own needs. Recently, schools have been established at Vancouver and at Saskatoon. This should improve the rate of Alberta graduates who stay in Alberta.

Summary—

Alberta's supply of medical doctors is fairly adequate but the distribution of them leaves a marked deficit in rural territories. There is nothing in sight to indicate any material change in requirements for medical services. Therefore, in looking forward one would expect an increase in the number of medical practitioners which would be proportional to the population.

DENTAL

At the end of 1954 Alberta had 377 dentists in practice or one for every 2,756 persons. The Canada average is one for every 2,838. Alberta is third among the provinces, being below British Columbia and Ontario in the dental-population ratio. The number of dentists is considerably below the

number required to meet the present demand for service and is even further below the number required to provide a complete service. It is probably safe to assume that under existing circumstances Alberta could use double the number of dentists and that the next 30 years should see the number of dentists increase more quickly than the population, to a point where there is one dentist to 1,400 people.

The field of preventive dentistry is just opening. One would hope that during the next few years it would advance sufficiently so that the present ratio of dentists would be adequate. One method is in sight, but not implemented, that could make a material reduction in dental work. This is fluoridation which might be applied in a variety of ways. The most suitable would appear to be the application of fluoride to the communal water supplies. This could be applied to about one-half of the population of Alberta and would make a 60% reduction in one dental condition (caries). This might reduce the need for dental service in Alberta by 20% or by 40% if it could be applied to the entire population.

For many years Alberta has operated the only dental school in Canada, west of the Great Lakes. As a result, a high proportion of the graduates are lost to other provinces, particularly to Saskatchewan and British Columbia. This school is turning out more than enough graduates to take care of Alberta's annual requirements. However, the loss to other provinces leaves Alberta with a deficit. The proper answer to this is the opening of additional dental schools in Western Canada.

Summary—

A very large increase in the number of dentists is indicated in order to supply the dental need in Alberta. It is doubtful if this increase can be obtained in the foreseeable future. The dental need could be materially reduced by the application of fluoridation.

NURSING SERVICES

Nursing Service is rendered in Alberta by Graduate Nurses, Nursing Aides, Mental Nurses, Ward Aides, Orderlies, etc. The approximate numbers of these working as at December 31, 1954, was:—

Graduate Nurses	4,050
Student Nurses	1,400
Nursing Aides	750
Mental Nurses	390
Ward Aides	1,200
Orderlies	? (small)

Since the early days of the recent war there has been a shortage of nursing personnel and, particularly, of graduate nurses. However, in the last year or so this situation has improved materially.

During the past ten years, the demand for nursing service has increased more rapidly than the general population, and one might expect that trend to continue. For example, a straight increase paralleling the increase in population would call for 7,200 nurses in 1985. The unusual rise indicates that the demand in 1985 might actually be 9,000. Other types of nursing service could be expected to increase proportionately. At the moment there is a definite trend for the auxiliary nursing service, known as nursing aide, to increase more rapidly than the graduate nurses.

The size of nursing schools can be expected to increase in proportion to the size of hospitals which, in turn, will increase in proportion to the

population. The nursing aides school is not related so directly to hospital service and so its size can be altered more readily.

Summary—

Nursing service may be expected to increase with general population or a little faster. There may be a shift of responsibility as between different types of staff. Schools for training of this staff can be expected to keep pace because of the increasing size of hospitals.

DIVISION OF MENTAL HEALTH

R. R. MacLean, M.D. — Director

Alberta's Economic Progress in terms of money to be expended in the Mental Health Division in the next thirty years, will be based mainly on the necessity for increasing the bed capacity for Institutions, with a corresponding increase in personnel for such Institutions, together with a progressive increase in the Guidance Clinic Service as represented by the increase in the number of these Clinics and the personnel involved. It would appear that any prediction as to the needs of Mental Health Services must be based on a realistic, rather than on a purely statistical established basis. On the latter basis, incredible numbers of persons would come within the category of the "institutionalizable", on the grounds of Mental Illness or Mental Deficiency of a Certifiable or a lesser degree of severity.

If one uses the criterion that one person out of every ten will suffer, or is suffering from a personality maladjustment of sufficient intensity to warrant Psychiatric care for some period during his life, it is apparent that very extensive services must be provided to take care of the situation at any given period of time. The case-load must be shared by Psychiatric Hospitals, Guidance Clinics and Private Psychiatric Practice. There seems to be no likelihood that Mental Hospitals as such, will ever pass out of existence, but will continue to increase in number and the extent of service provided, on a population basis. It would also be safe to predict that there will be an ever increasing number of Psychiatric Wards established in General Hospitals. All such Hospitals serving relatively large centres of population, should have an In-Patient as well as Out-Patient Psychiatric Service. Whether or not this service will be sponsored by Provincial Divisions of Mental Health will doubtlessly depend to some extent, at least, on trends towards something in the nature of State Medical Services.

In the field of Mental Deficiency the need for being realistic in relation to services to be provided must also be borne in mind. Predictions on a basis of standard estimates of the number of so called Certifiable Defectives, would again result in institutional demands of gigantic proportions. Even on the basis of one person in one hundred being a certifiable Defective, the problem takes on disturbing aspects. Another important consideration is the extent to which Departments of Education—rather than Health—are prepared to assume the responsibility for educating, training and supervising Mental Defectives, especially in the higher intelligent quotient groups.

Attached is a Table representing predictions of additional beds to be provided, and additional personnel sufficient to care for those occupying such beds. The entries in round numbers represent conservative estimates based on experience in past years, on certain accepted standards and pre-

dicted trends on a basis of almost certain public demand for increased services.

Acceptable estimates of the average cost of providing individual institutional or Hospital beds, together with acceptable average salary estimates per personnel member, would appear to be the only reasonable yardstick of value which could conveniently be used in arriving at a total estimated cost of the predicted increase in service.

With specific reference to the personnel of the Guidance Clinics, the estimated number per Clinic is placed at ten. This is based on the fact that it seems certain that all Guidance Clinics will be called upon to cover a total population somewhat greater than that which is used as a standard — that is, one Guidance Clinic per 100,000 urban population, or 200,000 rural population. A rough estimate of the operating cost of each Guidance Clinic per year would be in the neighborhood of \$50,000.00.

TREND OF MENTAL HOSPITAL PATIENT POPULATION AND PERSONNEL OF SAME

	YEAR 1955	YEAR 1965	YEAR 1975	YEAR 1985	Beds	INCREASE Personnel
Present Numbers in Mental Hospitals and Predicted Numbers on Present Trend	3,750	4,750	5,750	6,750	3,000	
Personnel in Mental Hospitals and Predicted Numbers on Present Trend	950	1,150	1,400	1,650		700
Estimated Standard Number Requiring Hospital Care and Trend on this Basis	5,000	6,250	7,500	9,250	4,250	
Estimated Personnel on Estimated Standard Trend	1,250	1,500	1,800	2,300		1,050

TREND OF INSTITUTIONS FOR MENTAL DEFECTIVES AND PERSONNEL OF SAME

	YEAR 1955	YEAR 1965	YEAR 1975	YEAR 1985	Beds	INCREASE Personnel
Present Number of Mental Defectives Institutionalized and Trend on this Basis	1,500	2,000	2,500	3,000	1,500	
Personnel on Present Basis of Institutionalized Defectives	400	500	600	700		300
Estimated Standard Number Requiring Institutionalization	2,000	2,500	3,000	3,500	1,500	
Estimated Personnel on Estimated Standard Trend	500	600	700	800		300

TREND OF GUIDANCE CLINICS AND PERSONNEL OF SAME

	YEAR 1955	YEAR 1965	YEAR 1975	YEAR 1985	Clinics	INCREASE Personnel
Present Number of Clinics and Trend on Standard* Basis	5 (2 Full-Time 3 Part-Time)	6	8	10	5	
Personnel of Clinics and Standard Trend	25 (18 Full-Time 7 Part-Time)	60	80	100		75

NOTE: *One Clinic with 10 personnel to Serve Mixed Rural and Urban Population of 200,000.

REPORT ON PUBLIC GENERAL HOSPITALS OF ALBERTA

M. G. McCallum, M.D., Director

ACUTE HOSPITALS

In submitting this report on Public General Hospitals for the purpose of analyzing the future trends in this field in Alberta, we are assuming that certain factors affecting hospital utilization, staff and costs are constant, and thus play no part in forecasting developments as of 1965, 1975 and 1985. Thus it is assumed: that monetary values will remain as at present, that unit hospital costs have levelled off and will remain stationary. There will be no attempt to assess ecological, social or medical factors affecting hospital utilization.

To project the trends of general hospitalization in the Province it is first necessary to assess the adequacy of our present hospital facilities. There were in 1954, the last year in which statistics were available, 99 acute hospitals in the Province, with a total of 6,546 beds for an estimated population of 1,039,000, providing 6.3 beds per 1,000 population, and an occupancy of 69.9%. Departmental analysis indicates that another 560 acute beds are needed, or a total of 6.8 beds per 1,000 population were needed to provide adequate care for the above population, and that future construction would only be required to meet population increases.

Up until 1919 the financing of a patient's hospital costs was primarily the patient's concern. In 1919 the Municipal Hospital program was begun, whereby in Municipal Hospital Districts the patient was only required to pay \$1.00 per day for public ward care and the remainder of the cost was borne by the municipality. In 1944, the Provincial Government accepted responsibility for all provincial maternity hospitalization, and in 1947 accepted responsibility for all Social Service recipients. In 1950, the Provincial-Municipal Hospitalization Plan was instituted whereby hospitalization costs were divided between the patient, the municipality and the Province. This has developed to such an extent that by 1955 practically all Alberta residents could enter the Provincial-Municipal Plan and have the municipality and Province finance all but a minimum amount of the patient's hospital costs. This would appear to be the method of hospital payments for the foreseeable future.

As a result of the Provincial-Municipal Hospitalization Plan, hospital utilization has continued to increase and will probably continue for some few years until all individuals have the plan available to them. The Province of Saskatchewan have noted a levelling off in hospital utilization in the last few years under their free hospitalization plan, and it would appear that Alberta will have the same experience once complete adoption of the plan has been attained. This will vary to some extent due to the changing population according to age groups and birth rates.

TABLE 1.

The following table shows population and hospitalization days in Alberta General Hospitals for 1951 - 1954

Year	Population ¹	Total Days ²	Days per 1,000 pop.	Average Stay
1951	939,500	1,487,000	1,582	8.9
1952	970,000	1,591,000	1,648	8.8
1953	1,020,000	1,716,000	1,682	8.8
1954	1,039,000	1,811,000	1,743	8.9

1 Dominion Bureau of Statistics
2 Excluding newborn

Due to the fact that maternity days vary with the birth rate, and that 1953 and 1954 were years of poliomyelitis epidemics, we have broken down the foregoing according to these groups in the following table:

TABLE 2.

Patient Days per 1,000 Population by Special Groups

Year	Poliomyelitis	Maternity	Other	Total
1951	26	214	1,268	1,508
1952	32	219	1,389	1,640
1953	72	219	1,391	1,682
1954	93	228	1,422	1,743

There are two important factors affecting the hospital days per 1,000 population: (1) The increase in poliomyelitis cases from 32 days per 1,000 population in 1952 to 93 days per 1,000 population in 1954; and (2) The institution of a complete hospital service for the residents of Alberta effective in July, 1953, whereby the patient received hospitalization at a very much reduced cost. This latter only became fully effective in 1954, and understandably accounts for a considerable part of the increase from 1,391 days per 1,000 population in 1953 to 1,422 days per 1,000 population in 1954. This increase per year according to hospitalization experience would appear to level off by 1958. Thus it would appear that there should be a downward adjustment of 60 hospital days per 1,000 population to allow for the disappearance of epidemic poliomyelitis, due to modern preventive treatment, in estimating future hospital days, and an upward revision of 30 days per year per 1,000 population for each year for four years to allow for increased utilization due to complete hospitalization provided through the Provincial-Municipal Hospitalization Program. This net upward adjustment in hospital days per 1,000 population would be 60. We propose to use this adjustment in calculating hospital days for the year 1965 and subsequently.

The average stay in hospital for maternity cases has gradually decreased from 8.4 in 1951 to 7.85 per case in 1954, and it would appear that this lower rate will continue.

The average stay in hospital for the age group 1 - 64 has remained approximately 9.2 days per case while that 65 - 69 has been approximately 13.5, and the 70 and over age group is 15.9.

The foregoing are the average days stay per case that we propose to use in calculating total hospital days for 1965, 1975 and 1985.

As a result of the data appearing previously, following are the estimated hospital days per 1,000 population and total hospital days for 1965, 1975 and 1985 on a basis of age grouping, average days stay, and adjusted to provide for increased days due to the Provincial-Municipal Hospitalization Program.

The following table gives the total hospital days and days per 1,000 population for 1954, 1965, 1975 and 1985.

TABLE 3.
Hospitalization Utilization by Group—1954, 1965, 1975 and 1985

GROUPS	1954		1965		1975		1985	
	Total Days	Days per 1000 Pop.	Total Days	Days per 1000 Pop.	Total Days	Days per 1000 Pop.	Total Days	Days per 1000 Pop.
Maternity -----	236,968	228.1	253,773	203.5	329,948	217.5	402,375	217.5
Ages 0-64 -----	1,143,470	1,100.6	1,336,312	1,066.5	1,619,200	1,067.4	1,971,286	1,065.6
Ages 65-69 -----	136,774	131.7	154,872	123.6	173,381	114.3	214,364	115.9
Age 70 and Over -----	293,163	282.2	371,694	296.6	470,386	310.1	585,502	316.5
Sub-total -----	1,810,375	1,742.6	2,116,651	1,689.2	2,592,915	1,709.3	3,173,527	1,715.5
Adjustment for increased utilization (60 days per 1,000 Pop.) -----			2,191,748	1,749.2	2,684,028	1,769.3	3,284,675	1,775.5

TABLE 4. Total Costs

	1954	1965	1975	1985
Total Costs*				
@ \$13.30 per day -----	\$24,281,041.00	\$29,150,248.00	\$35,697,572.00	\$43,686,177.00

* \$13.30 is average cost per patient day on basis of adults and children days, and includes depreciation.

ACUTE HOSPITAL STAFF AND SALARIES

In 1954 there was in the acute general hospitals a total staff of 8,460 receiving a total salary of \$13,778,990.00. This is being projected below for the years 1965, 1975 and 1985, based on comparative hospital days.

TABLE 5.

Total Hospital Staff and Salaries in Acute Hospitals—1954, 1965, 1975 and 1985

	1954	1965	1975	1985
Total Staff	8,460	10,242	12,542	15,349
Total Salaries	\$13,778,990.00	\$16,681,373.00	\$20,427,434.00	\$24,999,257.00

CHRONIC HOSPITALS

There is developing in the Province a trend toward chronic hospitalization to provide care for chronic, long term convalescent and incurable cases that need a certain amount of active treatment but are being cared for over a prolonged period. This type of hospitalization proposes to keep per patient day hospital costs very much lower than can be attained in an acute hospital.

In 1954 there were .41 beds in operation per 1,000 population for this purpose with considerably more under construction and being planned. It would appear this phase of hospitalization would continue to develop and must be considered in evaluating future hospital needs.

On data prepared by Ottawa the costs can possibly be one-half the acute hospital costs, with personnel limited to one-half acute hospital personnel. Beds per 1,000 population to meet full needs would appear to be 1.5, and occupancy approximately 90%.

The following table provides full information used in estimating needs and costs.

TABLE 6.

Estimated Chronic Hospital Utilization and Costs—1954, 1965, 1975 and 1985

	1954	1965	1975	1985
Beds per 1,000				
Population	0.41	0.75	1.0	1.5
Total Beds	429	940	1,517	2,775
Occupancy	90%	90%	90%	90%
Days per 1,000				
Population	135.0	246.4	328.5	492.8
Total Days	140,926	308,790	498,335	911,588
Cost per				
Patient Day	\$5.50 ¹	\$6.65 ²	\$6.65	\$6.65
Total Cost	\$775,093.00	\$2,053,453.00	\$3,313,927.00	\$6,062,060.00

1 Based on average operating cost plus depreciation.

2 Based on half the cost of acute hospital costs per patient day.

The cost per patient day in 1954 does not appear to provide facilities and services indicated for this type of patient. The upward revision is on the basis of Department of National Health and Welfare estimates.

The beds per 1,000 population are estimated as being desirable. Evaluation of the chronic bed situation would indicate that this estimate will not be reached for some years, hence the figures used.

CHRONIC HOSPITAL STAFF & SALARIES:

Chronic hospital staff and salaries are based on 50% of the acute hospital staff and salaries.

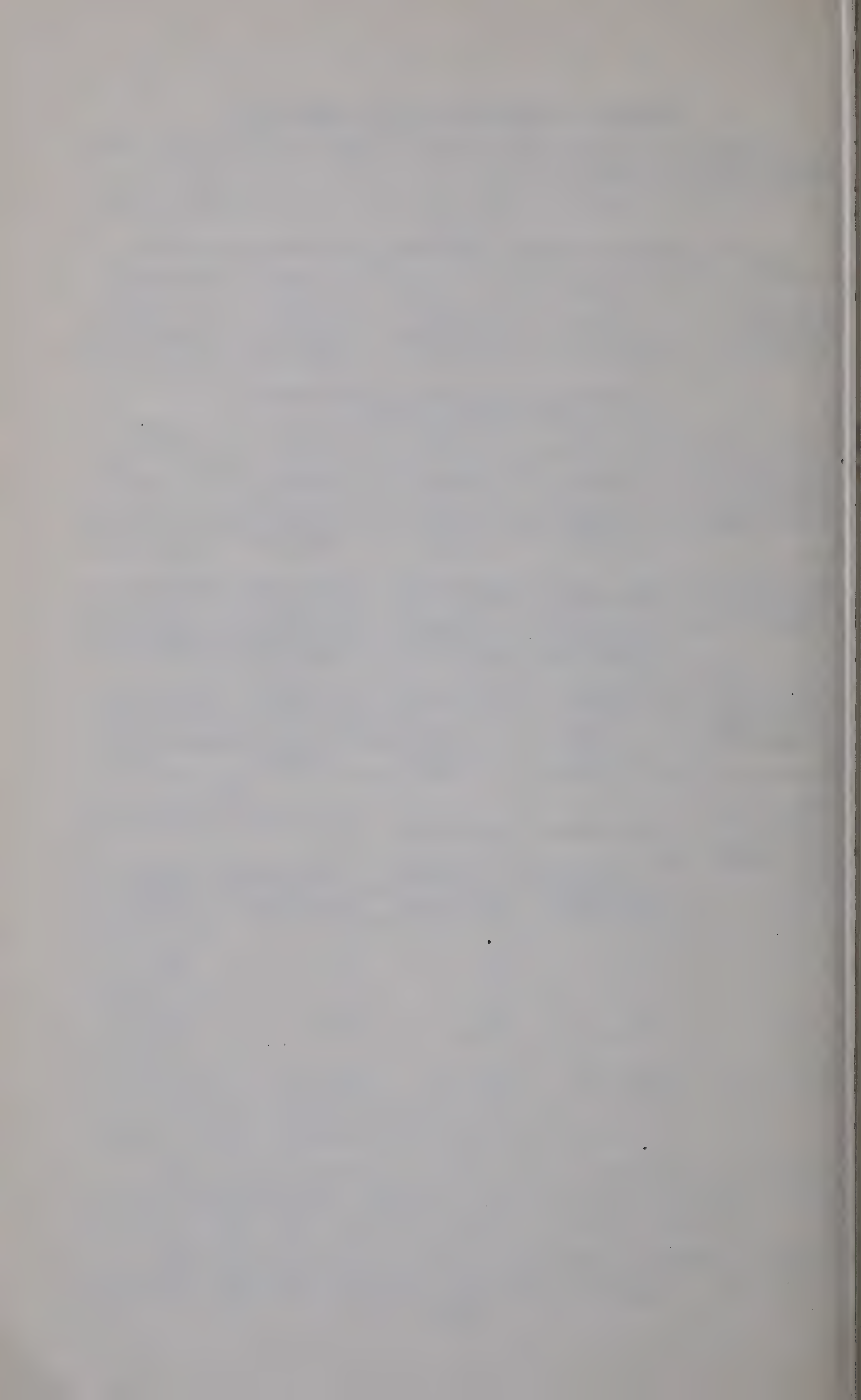
TABLE 7.

Total Hospital Staff and Salaries Based on 50% of Acute Staff and Salaries

	1954	1965	1975	1985
Total Staff -----	4,230	5,121	6,271	7,675
Total Salaries -----	\$ 6,889,495.00	\$ 8,340,686.00	\$10,213,717.00	\$12,499,628.00

FOLLOWING IS A SUMMARY OF THIS REPORT

	1954	1965	1975	1985
Total Acute Hospital Days -----	1,810,375	2,116,611	2,592,915	3,173,527
Total Chronic Hospital Days -----	140,926	308,790	498,335	911,588
Total -----	1,951,301	2,425,401	3,091,250	4,085,115
Total Acute Hospital Costs -----	\$24,281,041.00	\$29,150,248.00	\$35,697,572.00	\$43,686,177.00
Total Chronic Hospital Costs -----	775,093.00	2,053,453.00	3,313,927.00	6,062,060.00
Total -----	\$25,056,134.00	\$31,203,701.00	\$39,011,499.00	\$49,748,237.00
Total Acute Hospital Staff -----	8,460	10,242	12,542	15,349
Total Chronic Hospital Staff -----	4,230	5,121	6,271	7,675
Total -----	12,690	15,363	18,811	22,024
Total Acute Hospital Staff Salaries -----	\$13,778,990.00	\$16,681,373.00	\$20,427,434.00	\$24,999,257.00
Total Chronic Hospital Staff Salaries -----	6,889,495.00	8,340,686.00	10,213,917.00	12,499,628.00
Total -----	\$20,668,485.00	\$25,022,059.00	\$30,641,351.00	\$37,498,885.00



ALBERTA'S ECONOMIC PROSPECTS

PUBLIC WELFARE FOR THE PROVINCE OF ALBERTA

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DEPARTMENT OF PUBLIC WELFARE

HONOURABLE R. D. JORGENSEN
Minister

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Deputy Minister

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INTRODUCTION

The Government of Alberta, working for steady improvement in measures of Welfare, administers through the various branches of the Department of Public Welfare the services as set down by the Legislature. The work of the Department is done with a view to helping those who have met with unfortunate circumstances, and to assist those where rehabilitation is possible.

Since farming is the basic industry of Alberta it follows that the majority of the population is presently distributed throughout the rural agricultural areas of the Province. The move of young farmers from the land to larger centres which was so prevalent in previous years, has lessened noticeably, due principally to farm mechanization and modernization of rural homes and communities. New farming methods and equipment have of course, increased the demand for larger farms. Small holders have moved to urban centres. However, with new agricultural developments and settlement projects under provincial government auspices, many of these trained farmers have returned to the land. In this way the population of scattered communities has grown until they have become organized municipalities with their own welfare officers.

With the development of the oil industry in Alberta over the years, which resulted in the establishment of other allied industries, we find that there has been an influx of people from other parts of the Dominion and from other countries. This immigration has been felt most keenly in the urban centres, with the demand for housing and complementary services. Along with this shift in population and the adjustments that must be made, arise increased family problems which, in many cases, require the assistance of one or more Branches of the Department.

Recognizing the abundance of our natural resources, it would appear that conditions are favorable to an increase in industrial development over the years to come.

With this increased development and the state of flux that will exist over this period as far as the population is concerned, it is reasonable to expect a corresponding increase in the services required in the welfare field.

While industrial expansion is desirable in order that we may continue to experience an improvement in the standard of living, neither is possible without the firmly established family unit. Therefore, the help and guidance necessary toward this end will require that provision of facilities for welfare services be made on an increased scale as the population of the province increases. The material in graph and table form submitted, herewith, in each case shows a steady yearly increase in numbers receiving assistance during the past ten years under the various measures administered by this Department. It, therefore, is reasonable to expect that a corresponding increase may be expected as the population grows and new legislation is introduced during the next twenty-five years.

SUMMARY

In a final word, may we draw attention to some factors, which we feel will bear heavily on the future as far as welfare services are concerned.

If industry continues to develop on an increased scale, large numbers of families will continue to change location from year to year in following the changing industrial scene. In urban centres the pattern of life will change with the setting up of industries operating on a twenty-four hour working day.

We might also draw attention to the trend away from unquestioned standards on which family life was based in our forefathers' day. Today these standards are being seriously questioned and in some quarters are being disregarded or ignored. This is part of the pattern in working toward maturity in the life of our Province.

While this state of "mobility", and a changing emphasis on the basic values of family life continue, the effect will be reflected in the demand for welfare services. When a more static pattern of life has been reached in the future of this comparatively young Province, we may then experience a levelling off period, but we do not predict such a period in the next twenty-five years.

In summary we have included some highlights from the various phases of the work of the Department which speak for themselves:

The material in graph, table and explanation form covers the major activities of the Department on behalf of those requiring its services. The study is as complete as the allotted time would allow and is based on the statistics available for the past ten years. Forecasts for the future are made on the basis of the past, except in cases where this was not possible, due to new legislation. In those instances we have endeavored to take a forward look on the basis of short-term experience.

In dealing with the work of the various branches under respective headings the following may be noted:

1. Referring to the table and the graph the case load of ward children has increased from 2,419 in the year 1946 to a total of 3,526 on March 31, 1954, therefore, on the basis of the experience in the past we would estimate an increase in the gross case load of approximately 1,400 more children for each ten year period in the future, and a net increase of about 1,000 children for each ten-year period in the future.
2. Referring to the table and the graph respecting the adoption of government wards. Based on the period 1950-54, these indicate that we will be confronted with an increase of some 450 adoptions a year for each ten-year period in the future.
3. With regard to private adoptions indicated on the table and graph showing an increase of from 75 to 250 between the years 1946-55, the forward look would suggest that we will have an increase of about 200 more private adoptions for each ten year period in the future.
4. From the graph we would estimate that the rate of illegitimate births will increase at the rate of about 600 for each ten-year period in the future. The graph on the total number of births is included for comparison purposes.

Old Age Assistance

This is a comparatively new measure, effective since January 1, 1952, for the pension age group of 65 to 69 years. It will be observed that the payroll changes completely each five years due to transfers to Old Age Security. Although a levelling-off of recipients in this group has now begun, a definite trend is most difficult to estimate with authority. However, we reason from experience, and taking the present payroll of 5,477 as a basis, with the population steadily rising, a yearly growth of 400 recipients may be expected, increasing with the inflow of permanent residents.

Blind Pensions

Recipients in this group may be expected to increase in keeping with the rise in population and as new legislation lessens the age limit and raises the income ceiling.

Supplementary Allowances

The cost of this extra benefit is borne solely by the Province in addition to the hospital, medical and certain dental and oculist services paid on behalf of those qualifying in age groups from 65 years and over, and also those in receipt of pensions for the blind. As at December 31, 1954, there were 21,845 persons in pay. It can be expected that a steady annual rise in this group will occur with the increase in population.

Mothers' Allowances

These are paid to widows with school children, on a means test. Mothers are allowed to earn up to twelve hundred dollars per annum without affecting the allowance. In addition, hospital, medical, and certain dental and oculist services are provided, the cost of which is borne wholly by the Provincial Government. As the graph indicates, a steady rise may be expected during the next twenty-five years.

Widows' Pensions

This provincial measure has been in effect since April 1st, 1952, to widows from 60 to 64 years, for whom hospital, medical and certain dental and oculist services are provided. A steady rise can be expected in this group each year of from 60 to 70 as the population increases.

Disabled Persons Pensions and Disabled Persons Allowances

These two measures are in simultaneous operation in Alberta. The first is the Alberta Act. Pensions acceptable under this Act are borne wholly by the Province. Eligibility is based on information of employability.

Eligibility under the Federal "Disabled Persons Act" is based on strict medical grounds. The federal and provincial governments each contribute fifty percent of the pension cost. A steady yearly rise of recipients in both of these groups may be expected for the next twenty-five years.

Rehabilitation of Disabled Persons

There is a steady increase in the percentage of disabled persons and it is safe to say that the average trend of cases rehabilitated will rise steadily

in the years to come. We may expect that as the rehabilitation program gains strength a greater percentage of disabled persons will become employed and the present gap in trends will be greatly narrowed.

Direct, Indigent and Medical Services

The Department, through its field representatives and established offices provides assistance to eligible applicants living in unorganized districts and to persons who have not gained Alberta residence.

Organized municipalities look after the needs of their residents and of those sojourners who might be charges of other municipalities, or transients directly chargeable to the province. Contribution or reimbursement is made to the responsible municipalities on application to the Department.

It might be mentioned that an increase in public assistance always occurs during the cold months of the year, at which time many industrial and work projects are suspended. During this period there is an influx of relief applicants, especially single transients from all provinces of the Dominion. To meet this need the Department has excellently equipped hostels in Edmonton and Calgary where single transients may obtain temporary food and shelter. Married persons are provided with shelter, food and necessities until residence is established or until they can be rehabilitated.

Medical and hospital services are provided to those persons who urgently or otherwise require them.

As the graph indicates, it is expected that a general rise may be felt in this group during the next twenty-five years.

Aged and Infirm

This group is composed of persons unemployable due to old age or infirmities. Most are presently maintained in private nursing homes and government institutions for single men. The Department of Public Welfare, in accordance with regulations, contributes up to sixty percent of the cost of nursing home care. It is believed that a continuing increase in this group may be expected with the growth in population over the next twenty-five years.

Rehabilitation and Re-establishment of the Metis Population

The Metis Population Betterment Act is a measure that authorizes establishment of work and farming projects aiming at the development of self-initiative. At present there are six colonies with 5,905 acres under cultivation. There are four hundred and ten families with 1,629 children. The settlers are engaged in farming, fishing, trapping and lumbering. The greater portion of these people are well established and self-supporting. Establishment of sound medical and hospital services has greatly reduced the element of disease. Vermin infestation, so prevalent in Indian homes, is rarely heard of on the Colonies.

The final aim, as the Colonies develop and require less supervision, is to form them into Metis Improvement Districts.

Inspections Branch

Welfare offices are located in the larger centres of the Province adjacent to which Inspectors are allotted zones or areas for which they are responsible for reporting on matters of welfare. The volume of work is expected to grow as new measures are introduced during the next twenty-five years.

DEPARTMENT OF PUBLIC WELFARE

CHILD WELFARE BRANCH

In the Province of Alberta children are made wards of the Government by two different methods.

1. **By Legal Transfer of Guardianship**—These cases concern mainly the unmarried mother and her child. A mother who feels she is unable to provide for her child, and because of her marital status, finds it necessary to surrender her child, may under the Act make application to the Child Welfare Commission, composed of five members, for approval of her intention to surrender. When the approval has been granted, the completed legal Transfer of Guardianship between the mother and the Superintendent of Child Welfare makes the surrender binding and the child then becomes a government ward.

Surrender by Transfer of Guardianship is a process that has been worked out over the years in the light of experience. The validity of surrender by Transfer of Guardianship has been upheld by the Alberta Court of Appeal. It has been found to be the most satisfactory method by which the mother is offered reasonable privacy, the child is provided maximum security and the Child Welfare Branch is in the proper position to proceed with legal adoption.

2. **By Order of Judge of Juvenile Court**—When a condition of neglect or conditions contributing to the neglect of a child are brought to the attention of local authorities, the case may be brought before a Juvenile Court Judge who, on hearing the evidence of parents, child and authorities concerned, may if he deems necessary, make an order for permanent or temporary wardship. From the date of such an order by the Juvenile Court the child or children concerned become a government ward.

In graph #CW—1 the case load (total number of children dealt with during the year) begins at 2,419 for the year 1947 and a steady rise is indicated with the exception of the year 1948-49 when there was a very slight decrease in the case load. The average trend would indicate an increase in case load of 138 children per year, while the net increase in number of wards would be 98 children per year.

The legal adoption of children who are government wards is indicated on graph #CW—2, where it may be noted during the period of years from 1946 to 1955 there are 3 years where some decline is shown and 6 years where a decided increase is evident.

From 1946 to 1955 the increase over the 9 year period was 277 adoptions which would indicate an increase trend of 31 children adopted per year.

The decline between 1948-49 in adoptions may be explained as the result of the concern of prospective adoptive parents in the light of publicity previous to the hearing of the Howson Royal Commission.

Under Alberta legislation the prospective private adoptive home must be approved by the Home Investigating Committee who, in turn, recommend the home to the Child Welfare Commission.

After the child's one year probationary period of residence in the adoptive home the petition for adoption is presented to the Court by the Child Welfare Commission. The Judge of the District Court has the auth-

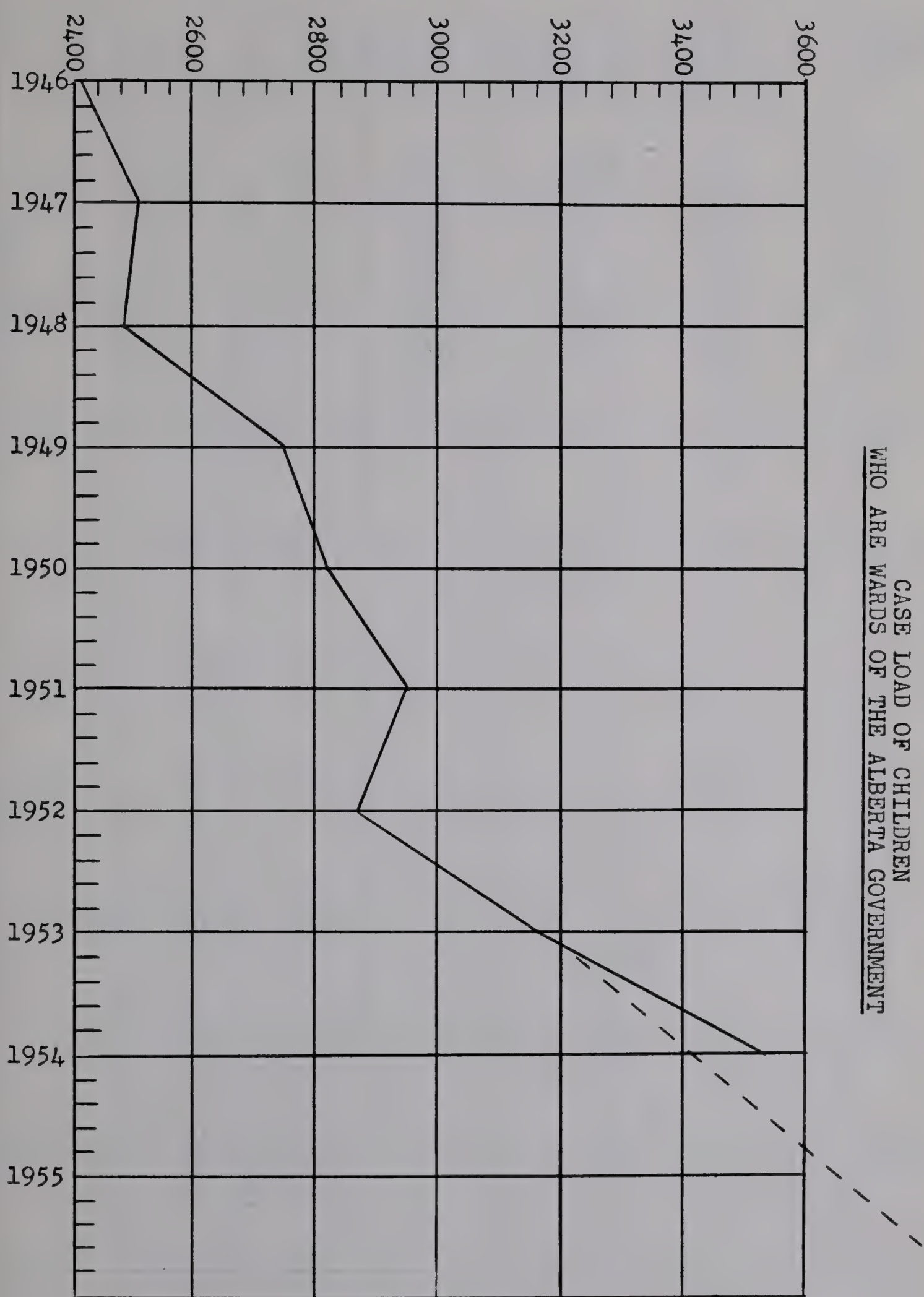
ority to waive the one year probationary period if circumstances warrant such a decision.

As indicated on Graph #CW—3 private adoptions ranged from 75 in 1946 to 250 in 1955. The trend on this basis indicates an increase of 19 private adoptions per year.

Graphs #4 "Total births" and #5 "Illegitimate births" are included in order that comparison may be made with graphs #1 "Wards" and #2 & #3 "Adoptions".

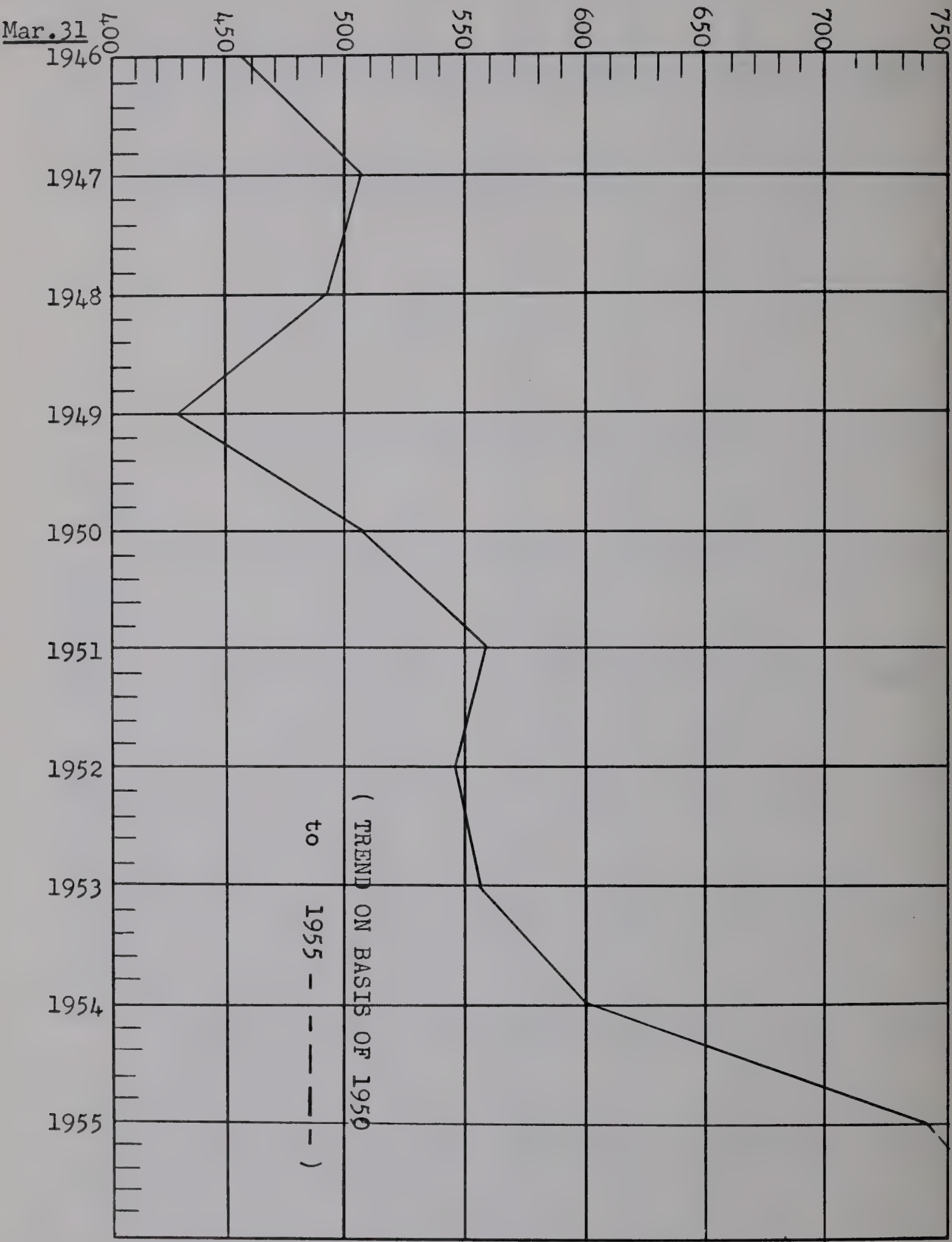
It will be noted that the trend is upward and this is expected to continue during the next twenty to thirty years.

Graph No. C. W. 1.



CASE LOAD OF CHILDREN
WHO ARE WARDS OF THE ALBERTA GOVERNMENT

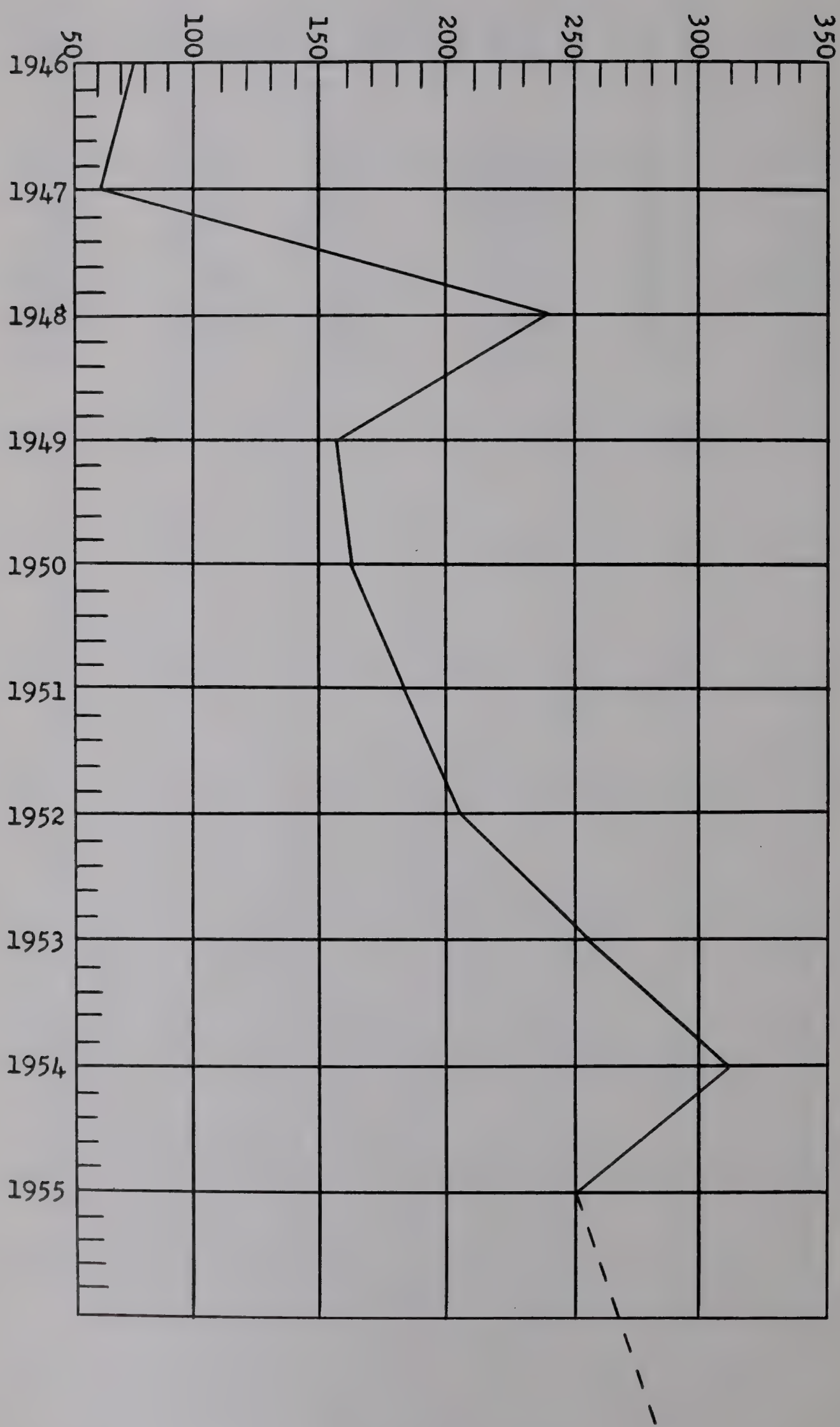
Graph No. C. W. 2.



**Statement Showing Net and Gross Case Loads of Children who were
Government Wards during each fiscal year
(April 1st - March 31st)**

	Net	Add	Case Load Gross	Returned to Parents, etc.	Adoptions	Case Load Net
1946 -----	1,594	825	2,419	143	507	1,769
1947 -----	1,769	733	2,502	263	494	1,745
1948 -----	1,745	745	2,490	245	427	1,818
1949 -----	1,818	930	2,748	218	506	2,024
1950 -----	2,024	799	2,823	198	558	2,067
1951 -----	2,067	884	2,951	323	546	2,082
1952 -----	2,082	792	2,874	268	561	2,045
1953 -----	2,045	1,116	3,161	179	599	2,383
1954 -----	2,383	1,143	3,526	237	734	2,555
1955 -----	2,555					

Graph No. C. W. 3.



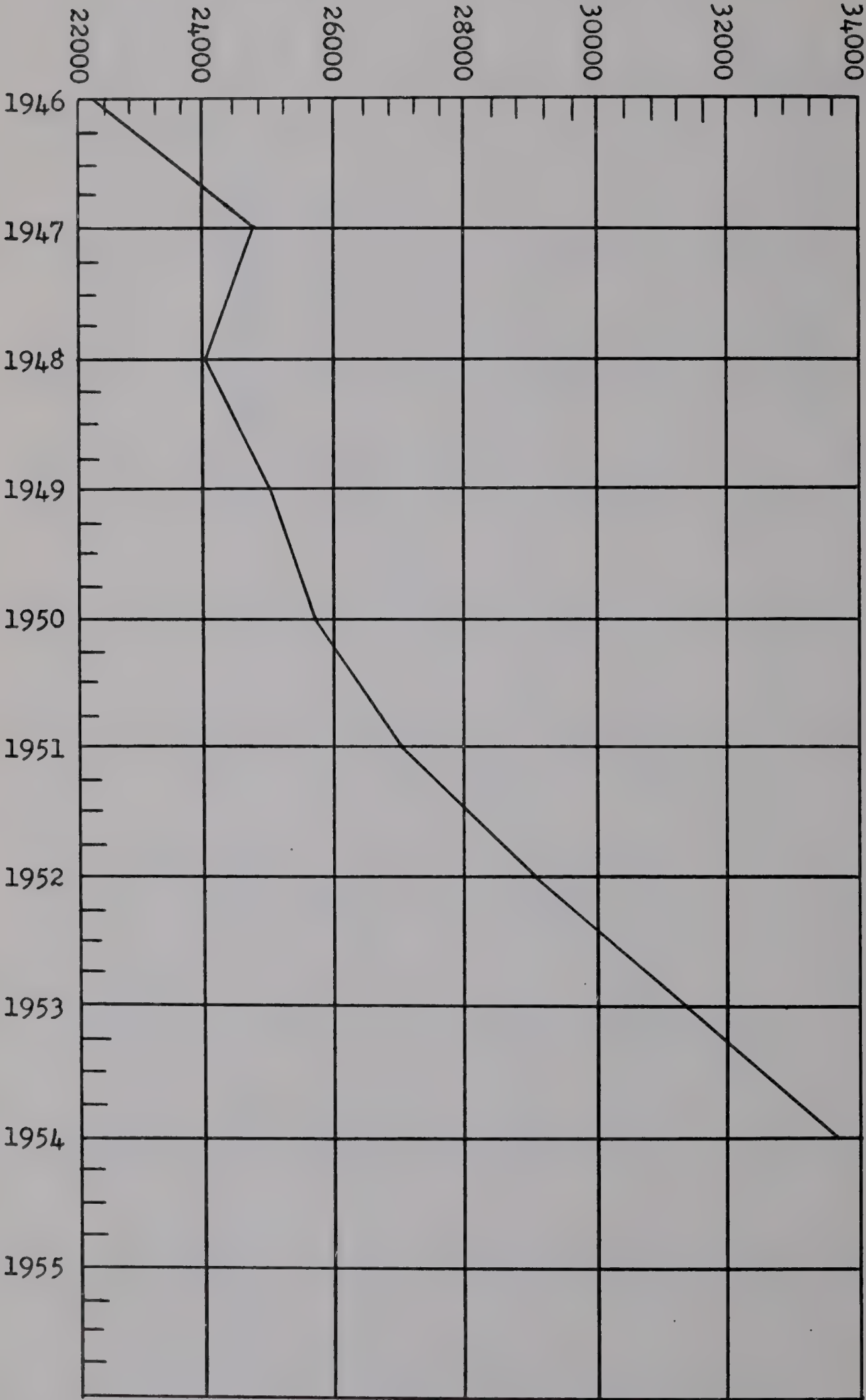
PROVINCE OF ALBERTA
Private Adoptions

PRIVATE ADOPTIONS SUBMITTED TO COURT BY THE CHILD WELFARE
COMMISSION

During the fiscal years from April 1st to March 31st

Year ending March 31st	
1946	75
1947	61
1948	239
1949	157
1950	162
1951	181
1952	203
1953	256
1954	310
1955	250

Graph No. C. W. 4.



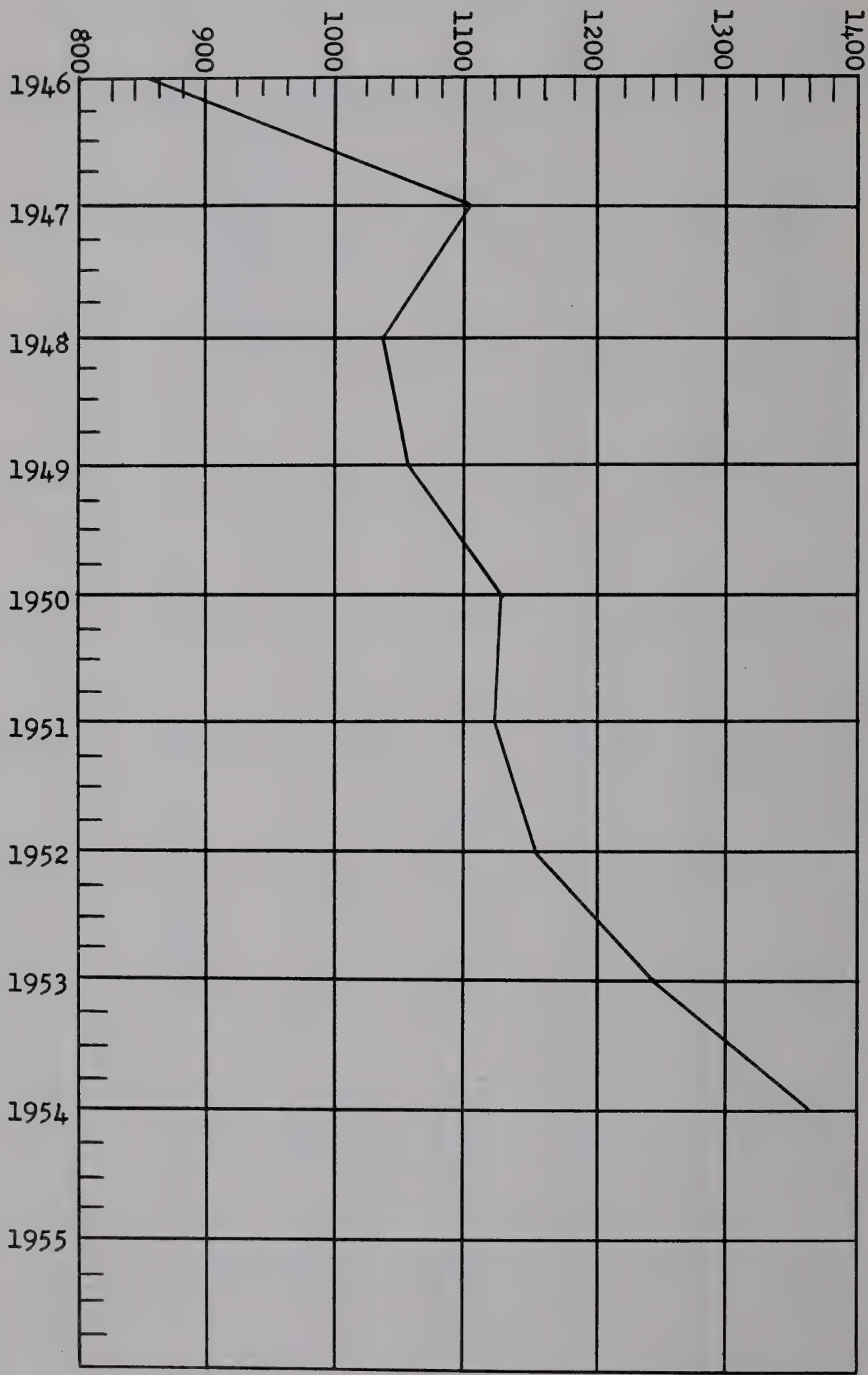
PROVINCE OF ALBERTA

Births

Fiscal year
April 1st to March 31st

1946	22,294
1947	24,778
1948	24,077
1949	24,962
1950	25,672
1951	27,041
1952	29,042
1953	31,351
1954	33,629

Graph No. C. W. 5.



PROVINCE OF ALBERTA
Illegitimate Births

PROVINCE OF ALBERTA
Illegitimate Births

Fiscal year April 1st to March 31st	
1946	855
1947	1,106
1948	1,032
1949	1,047
1950	1,146
1951	1,141
1952	1,157
1953	1,240
1954	1,361

OLD AGE ASSISTANCE

New legislation with respect to Old Age Pensions was introduced on January 1st, 1952, when the Dominion Government undertook to pay directly all pensioners 70 years of age and over. The Federal Government also brought into force the Old Age Assistance Act on a fifty-fifty contributory basis with the provincial governments effective January 1st, 1952. This included persons from the ages of 65 to 69 inclusive. After the transfer of all persons who had attained the age of 70 years there were left on this Department's payroll as at March 31st, 1952, 2,954.

The payroll as at August 31st, 1955, contained 5,477 pensioners of the 65 - 69 age group.

The two years from April 1st, 1952, to March 31st, 1954, and up to August 1955 are considered to be insufficient time to estimate a trend by graph. We, however, believe a levelling off in this pension group has started to develop, and from experience an increase of about four hundred per year can conservatively be estimated.

OLD AGE ASSISTANCE

Fiscal year	Pensioners on pay roll at end of previous year	Additions Granted, transfers Reinstatements	Deductions Deceased, transfers Suspensions	Pensioners on pay roll
1952	2,954			
1953	2,954	2,935	1,201	4,688
1954	4,688	1,944	1,619	5,013

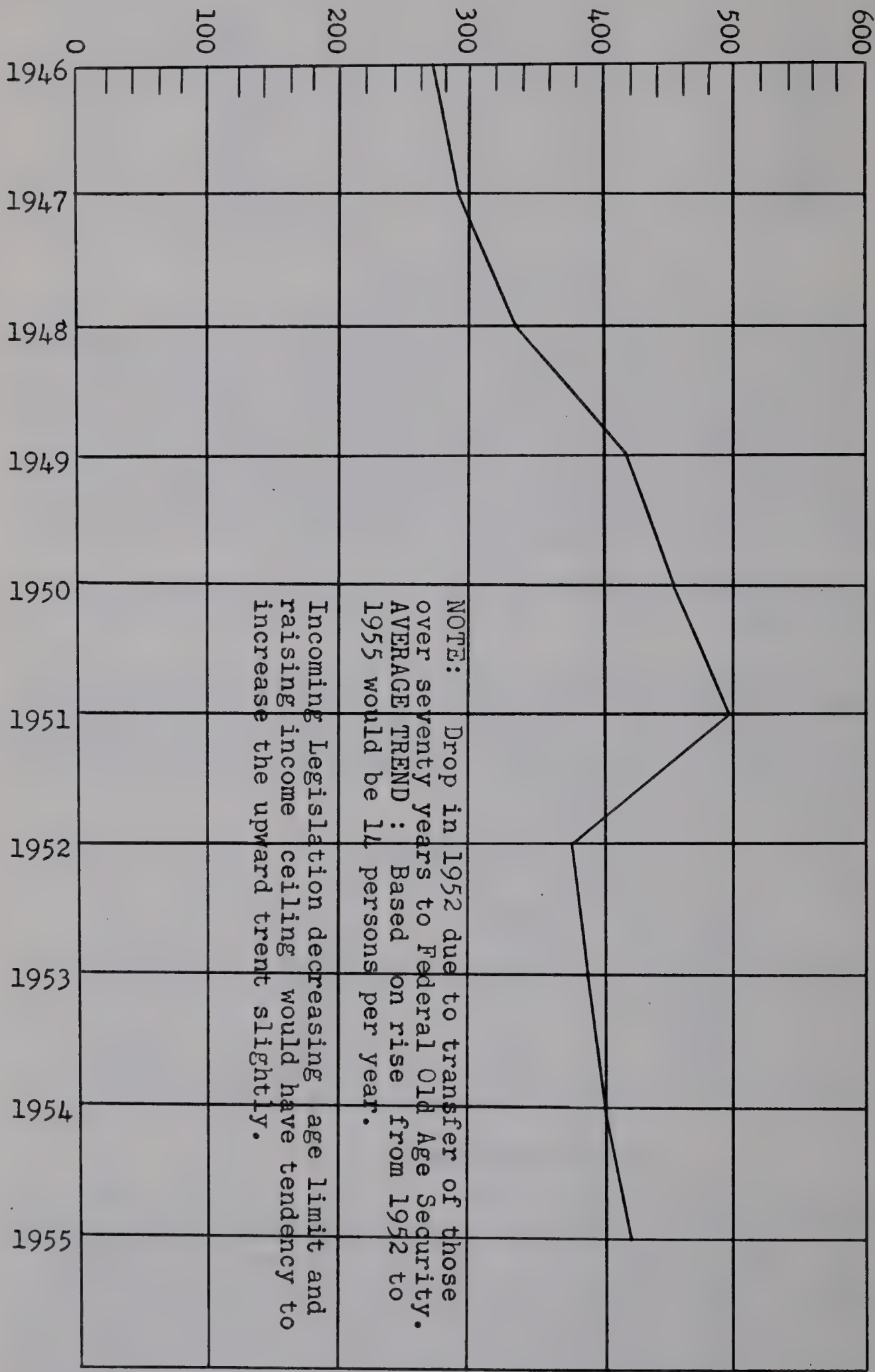
BLIND PENSIONS

Pension allowances to Blind Persons were paid under the Old Age Pensions Act up to January 1, 1952, when new legislation was brought into being. The major changes effected by this new legislation resulted in a change in residence qualifications being reduced and the income ceiling being increased. With the introduction of the Federal Old Age Security Program for persons of seventy years and over January 1, 1952, all blind persons in this age range were at this time transferred to the federal pension plan.

The above reaction can be noticed on the graph which indicates a decline from 1951 to 1952 but otherwise follows a steady increase to the

Graph No. 6

PROVINCE OF ALBERTA
Blind Pensions



present number of 419 persons in receipt of Blind Pensions, at August 31, 1955.

The forecast trend based on the period from 1952 to 1955 would give an average yearly increase of 14 pensions per year. It should be noted that incoming legislation decreasing the age limit and raising the income ceiling further would have a tendency to increase the upward trend slightly.

BLIND PENSIONS

Fiscal Year	Pensioners on pay roll end previous year	Additions (granted, transferred, reinstated)	Deductions (deceased, transferred, suspensions)	Pensioners on pay roll
Mar. 31, 1945				247
1946	247	44	22	269
1947	269	39	18	290
1948	290	68	26	332
1949	332	117	31	418
1950	418	73	38	453
1951	453	83	42	494
1952	494	77	195	376
1953	376	90	83	383
1954	383	79	62	400
Aug. 31, 1955				419

PROVINCE OF ALBERTA
SUPPLEMENTARY ALLOWANCES

The Supplementary Allowances under Alberta legislation are paid according to circumstances to old age pensioners and blind pensioners who are able to qualify.

On March 31st, 1946, there were 12,000 persons in receipt of Supplementary Allowances and by March 31st, 1954, the number enrolled had increased to 21,845. A portion of this rise can be explained by the fact that some 4,000 persons were added to the payroll following January 1952, at which time new legislation bringing in the 65-69 age group came into effect. The full cost of Supplementary Allowances and Hospital and Medical Services for those receiving these benefits is borne by the Province of Alberta.

It is not considered necessary to complete a graph on this allowance as all persons taken into consideration are included in other legislation dealt with in the study. However, the attached statement indicates the number of Supplementary Allowances in pay during the fiscal years from April 1st to March 31st. These figures are the net case load and do not include rejections or suspensions.

SUPPLEMENTARY ALLOWANCES
paid to Blind Pensioners and age groups 65 years and over

Year	Number
1946	12,000
1947	12,900
1948	13,672
1949	15,160
1950	16,569
1951	18,125
1952	17,712
1953	21,631
1954	21,845

MOTHERS' ALLOWANCES

The purpose of The Mothers' Allowance Act is to help needy mothers raise their children in a family group. The Department recognizes that a mother's care is essential to the well-being of her children and Mothers' Allowance is regarded as a basic welfare service.

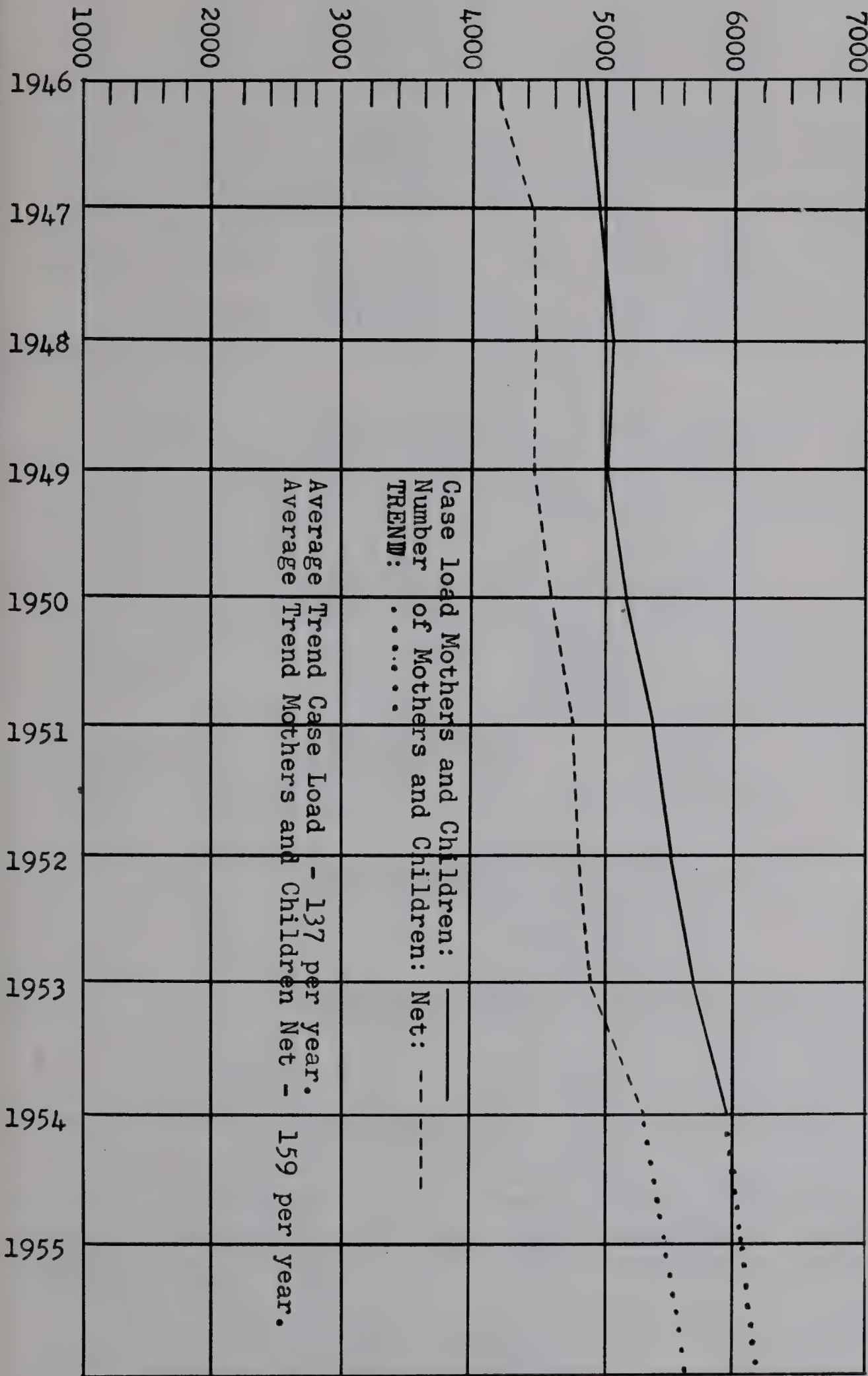
The Act makes provision for financial aid to needy widows with children up to the age of 16 years, or children between the ages of 16 and 18 years who are attending school regularly and making satisfactory progress. It makes provision also for the wife and children of a man committed to a mental hospital under The Mental Diseases Act; for a woman and children who have been deserted for three years or more, and for a woman with children who has been living in marital relations with a man for a period of at least five years prior to his death and whose children are registered in his name.

The 1946 Amendment to The Mothers' Allowance Act provides that the allowance may be continued for two years after the sixteenth birthday of any child making satisfactory progress in school. By continuing the allowance for this period, provision is made for fitting the child better to take his place in society.

The Mothers' Allowance graph covering years 1946-55 indicates the total number of mothers and children dealt with during the year as the caseload, and the forecast trend in this instance would indicate an increase of 137 mothers and children per year. The number of mothers and children on the payroll at the end of each fiscal year is shown by the net figure and the trend indicated would be an increase of 159 mothers and children per year.

Graph No. 7.

PROVINCE OF ALBERTA
Mothers' Allowance



Fiscal Year	Number Allowances in pay	Number Allowances Added	Total Allowances	Cancel- lations	Allowances in pay as at Mar. 31	Children in pay as at Mar. 31	Mothers & Children in pay as at Mar. 31 (net caseload)	Children added during year	Children in pay during year	Case Load Total Mothers & Children in pay during year
Previous year	1,346									
1946		213	1,559	250	1,309	2,887	4,196	388	3,275	4,834
1947		252	1,561	185	1,376	3,074	4,450	311	3,385	4,946
1948		252	1,628	235	1,393	3,073	4,466	358	3,431	5,059
1949		257	1,650	258	1,392	3,032	4,424	329	3,361	5,011
1950		287	1,679	217	1,462	3,110	4,572	337	3,447	5,126
1951		287	1,749	246	1,503	3,191	4,694	371	3,562	5,311
1952		304	1,807	319	1,488	3,229	4,717	443	3,672	5,479
1953		340	1,828	304	1,524	3,360	4,884	470	3,830	5,658
1954		364	1,888	276	1,612	3,632	5,244	421	4,053	5,941

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* †

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*

†

Previous year

Province of Alberta
DEPARTMENT OF PUBLIC WELFARE
WIDOWS' PENSIONS

"An Act respecting Widows' Pensions", came into effect April 1st, 1952. This Act provides assistance to needy widows between the ages of 60 and 65 years, who have resided at least 15 years in Canada prior to their sixtieth birthday and have resided in Alberta for the greater portion of the three years immediately preceding the date of application. Payment is made to a maximum of \$40.00 per month, which may be reduced by income. The full cost of this pension and of hospital and medical services for those receiving these benefits is born by the Province of Alberta.

At the end of the first year this pension was in effect, there were 529 widows on the payroll and this had steadily increased from 1952 to August 31st, 1955 to a total of 735 recipients.

Due to the short time this pension has been in effect it is felt there is little value in a graph as a levelling off point has not yet been reached.

On the basis of experience the trend would indicate an increase of from 60 to 70 additional persons to the payroll each year.

WIDOWS' PENSIONS

Fiscal Year	Pensioners on payroll at end previous year	Additions Granted, Transfers, Reinstatements	Deductions Deceased, Transfers, Suspensions	Pensioners on payroll
March 31st				
1953				529
1954	529	317	199	647

DISABLED PERSONS' PENSIONS

and

DISABLED PERSONS' ALLOWANCES

The Province of Alberta, unique among the ten Canadian Provinces, is at present operating two plans for assisting the disabled persons of the province.

The Disabled Persons' Pensions Act was passed by the Legislature of the Province of Alberta on March 31, 1953, and came into effect June 1, 1953. Under this Provincial Act, approximately 1,600 pensions had been approved as of January 1, 1955. At that time, the second Act came into effect in Alberta.

This second Act is entitled "The Disabled Persons' Act", passed by the Parliament of Canada June 26, 1954.

The total Provincial case load as of January 1, 1955 was examined by a Medical Review Board for possible inclusion in the Federal payroll. Approximately eight hundred of the Provincial cases were shortly placed under the Federal Act, as shown in the accompanying graph. Many cases of

doubtful eligibility under the Federal Act were deferred for further medical information.

At the present time the two Acts are in simultaneous operation. Applications for disabled persons' pension are considered for eligibility first under the Federal Act, then under the Provincial Act. The Federal Act is based on strict medical grounds established by a group of specialists; the Provincial Act is based upon grounds of employability. It is expected that each Act will continue to serve differing needs for assistance.

It would appear the trend under the Provincial Act is now fairly stable, as slightly over 1,000 persons have remained on the Provincial Payroll for the past three months. The trend under the Federal Act is not yet stabilized, due to such factors as:

- (1) The administrative staff is only now catching up on the backlog of work involved in evaluating Provincial Pensions for possible inclusion under the Federal Act.
- (2) Cases which were previously rejected on various grounds are gradually applying under the Federal Act.

Under both the Provincial and Federal Acts governing Disabled Persons' Pensions or Allowances, the newness of the programs makes projection of trends difficult. However, the present levelling off noticeable on the Provincial figures can be expected to be duplicated on the Federal figures. After that time, it is anticipated that there will be a steady, slow rise in pension payments, as the population of the province increases and the percentage of disabled persons increases. It is an accepted fact that there will be a steady increase in the percentage of disabled persons in the population at large, due to several factors:

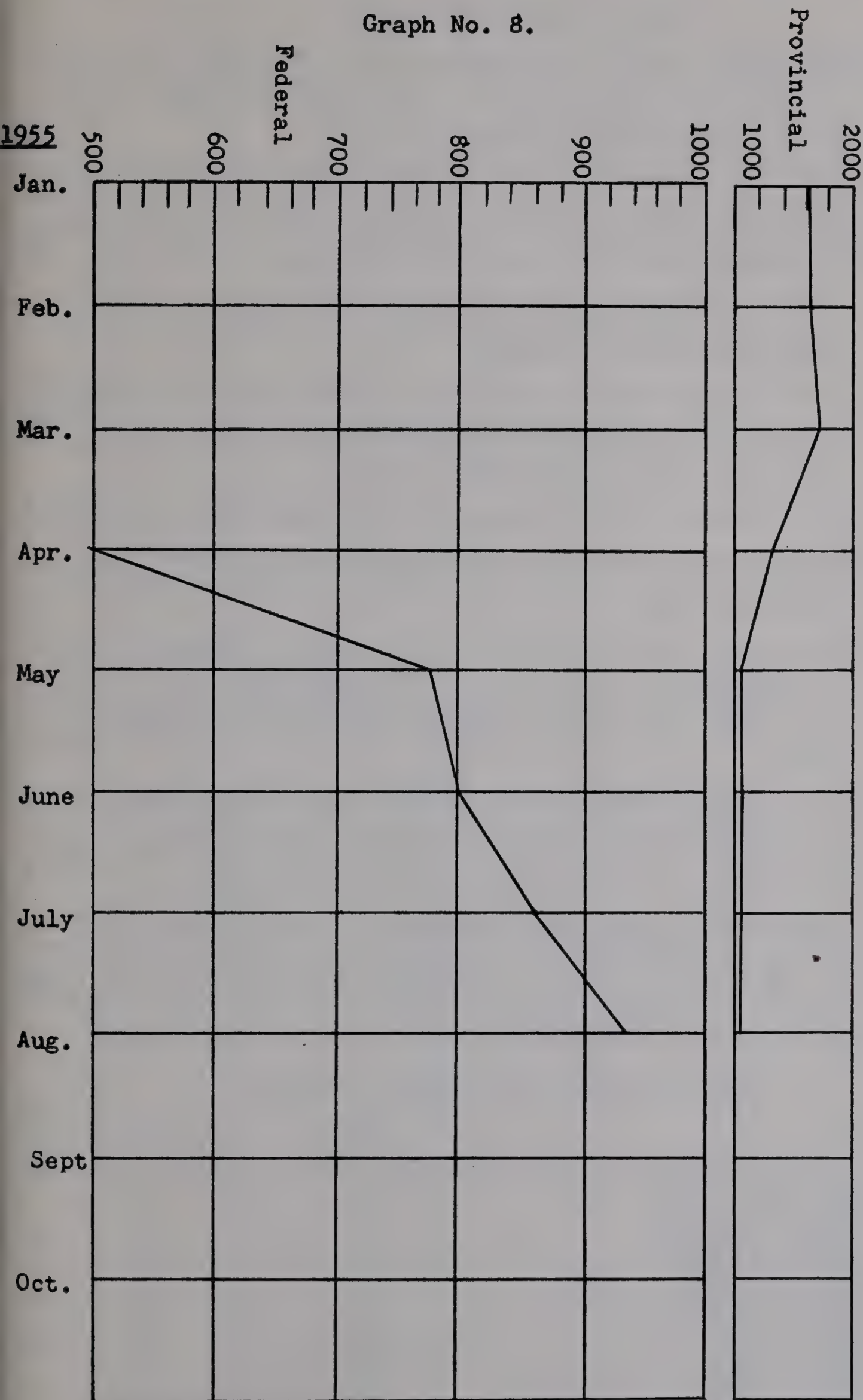
- (1) The success of new medical techniques in keeping alive persons suffering from disease or injury.
- (2) The alarming increase in persons seriously disabled as a result of automobile accidents.
- (3) The general aging of the population.

In summary it is expected that the trend lines on the graphs for Federal and Provincial Disabled Persons' Pensions will eventually be roughly parallel, with both rising steadily.

DISABLED PERSONS' PENSIONS
and
DISABLED PERSONS' ALLOWANCES

Number of Pensioners as at	Provincial	Dominion
January 31, 1955	1,636	-----
February 28, 1955	1,639	-----
March 31, 1955	1,713	-----
April 30, 1955	1,284	496
May 31, 1955	1,064	772
June 30, 1955	1,085	803
July 31, 1955	1,079	858
August 31, 1955	1,078	928

Graph No. 8.



DISABLED PERSONS' PENSIONS
and
DISABLED PERSONS' ALLOWANCES
Monthly Totals

REHABILITATION OF DISABLED PERSONS PROGRAM

Department of Public Welfare

This program, a joint undertaking of the Government of Canada and the Government of Alberta, commenced operation in Alberta in April, 1954. At this stage, it is a program of co-ordination of existing services available for the rehabilitation of disabled persons.

Requests for case service were accepted in Alberta from the start of the program. As shown on the accompanying graph, there has been a steady increase in the number of cases applying for service. This trend does not reflect the prospects for the future, for the following reasons:

- (1) There has been no active program of case-finding. Cases handled are merely those applying voluntarily, or referred by other welfare or government agencies.
- (2) No medical services are as yet provided under the program. Large numbers of potential rehabilitation cases are being held in abeyance pending the clearing of policy on the payment of costs of medical rehabilitation services.
- (3) The existence of the program has not been widely advertised.
- (4) The present staff of the government program is small, and the agencies whose services are called upon also are hampered by lack of staff.
- (5) There is a steady increase in the percentage of disabled persons in the country at large. This trend is expected to rise steadily; some informed medical opinions estimate that in twenty-five years there will be three disabled persons for every able-bodied one.

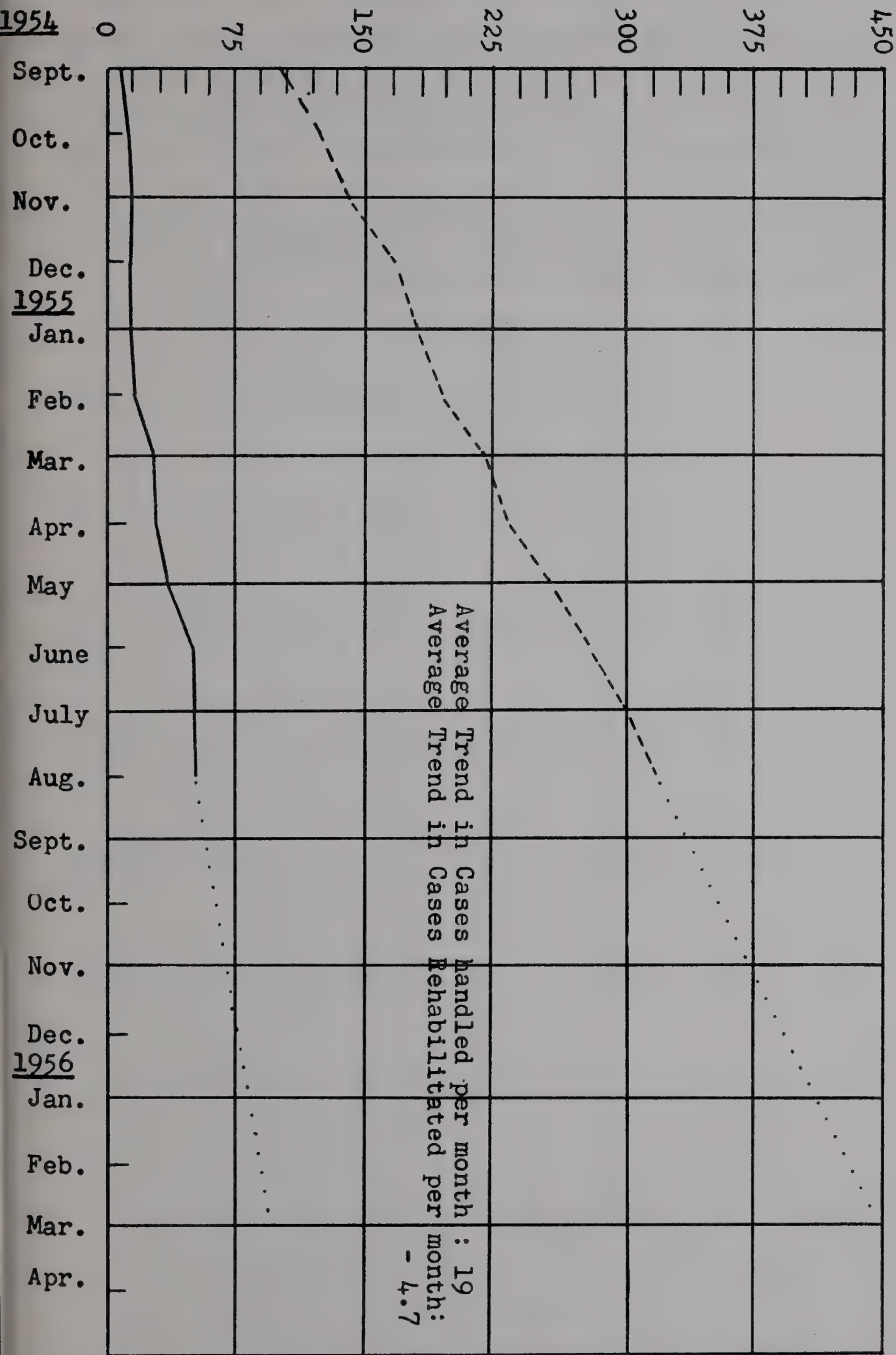
It should be noted that the Rehabilitation of Disabled Persons Program does not include cases which are the direct responsibility of the Department of Veterans' Affairs, and includes only a very few of the many cases handled yearly by the Workmen's Compensation Board.

In summary, it can be said that there is no doubt whatsoever that the average trend in cases handled per month will rise steadily in the years to come. So, too, will the trend in rehabilitated persons per month. It is expected that the gap between these two trends will be greatly narrowed as the program gains strength, although it will never entirely disappear.

REHABILITATION OF DISABLED PERSONS

	Cases Handled	Cases Rehabilitated
September 30, 1954	103	7
October 31, 1954	124	10
November 30, 1954	140	13
December 31, 1954	164	12
January 31, 1955	175	15
February 28, 1955	192	19
March 31, 1955	216	24
April 30, 1955	233	28
May 31, 1955	256	35
June 30, 1955	279	51
July 31, 1955	296	52
August 31, 1955	313	59

Graph No. 9.



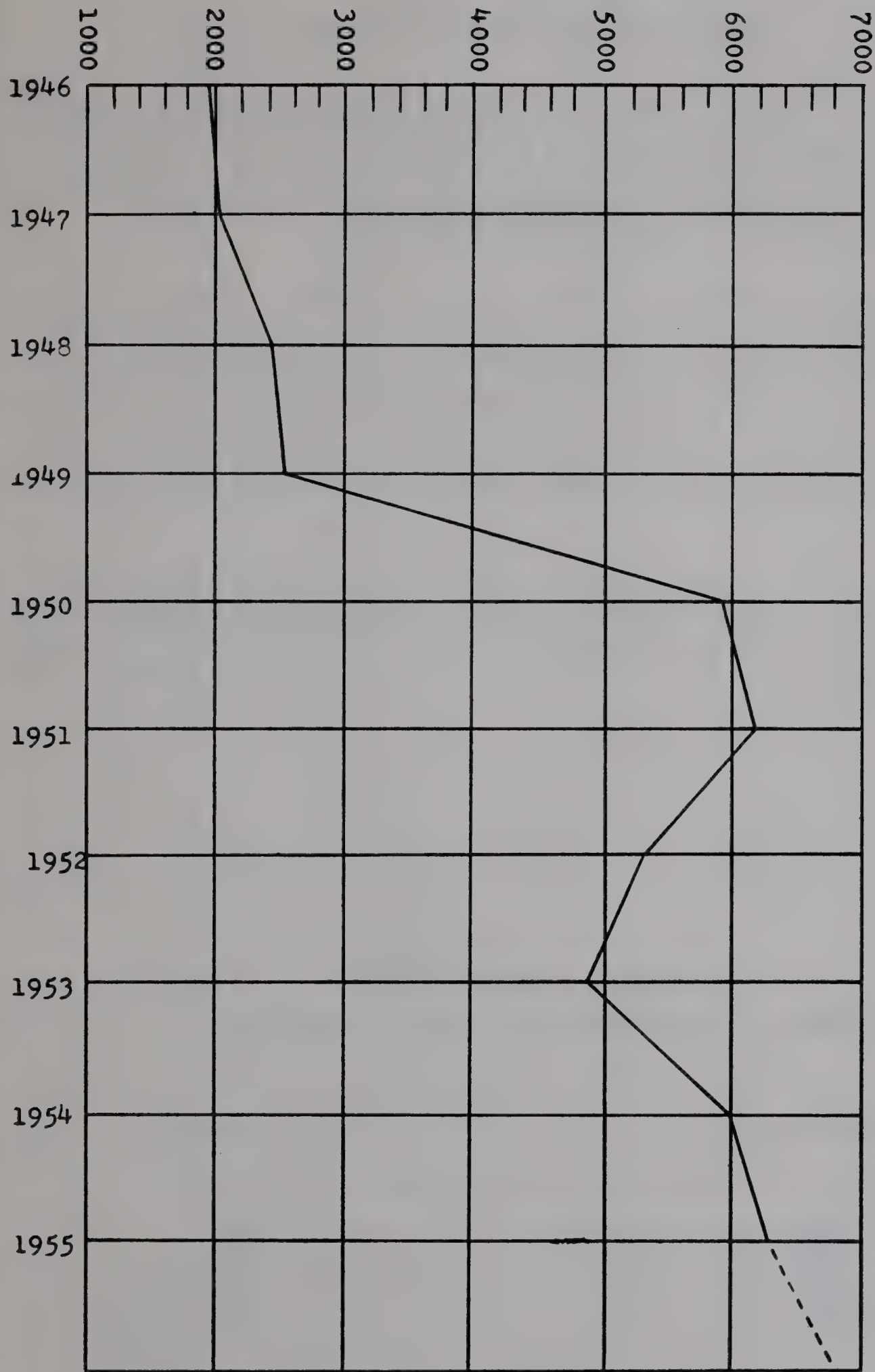
ASSISTANCE INCLUDING AGED AND INFIRM

The value of social service cannot be measured in numerical terms. It is only by continued contact of field workers that achievement can be appreciated. The attached graph pictures the numerical trend of assistance issued to families during the fiscal years 1945-1946 to March 31, 1955.

Although the general trend has been upward, the sudden increase during 1949-50 was due to introduction of new legislation, namely, The Public Welfare Assistance Act and amendments to The Home for Aged or Infirm Act, whereby the Department of Public Welfare is authorized to make grants to municipalities on behalf of residents in receipt of assistance.

The sudden drop in recipients during the years 1951-1953 was principally due to municipal personnel administrative changes and their not taking advantage of contributory legislation. It is considered the trend will rise slowly during the next twenty or thirty years.

Graph No. 10



DIRECT ASSISTANCE
INDIGENT AND MEDICAL SERVICES
AND IN HOMES FOR AGED AND INFIRM

Department of Public Welfare
DIRECT, INDIGENT AND MEDICAL SERVICES
During the Fiscal Year Periods

The Public Welfare Assistance Branch administers welfare services directly and through representatives in unorganized areas. Municipalities are equipped to issue assistance to their residents and are assisted by the Department of Public Welfare in the form of grants up to sixty per cent of expenditure in keeping with existing regulations.

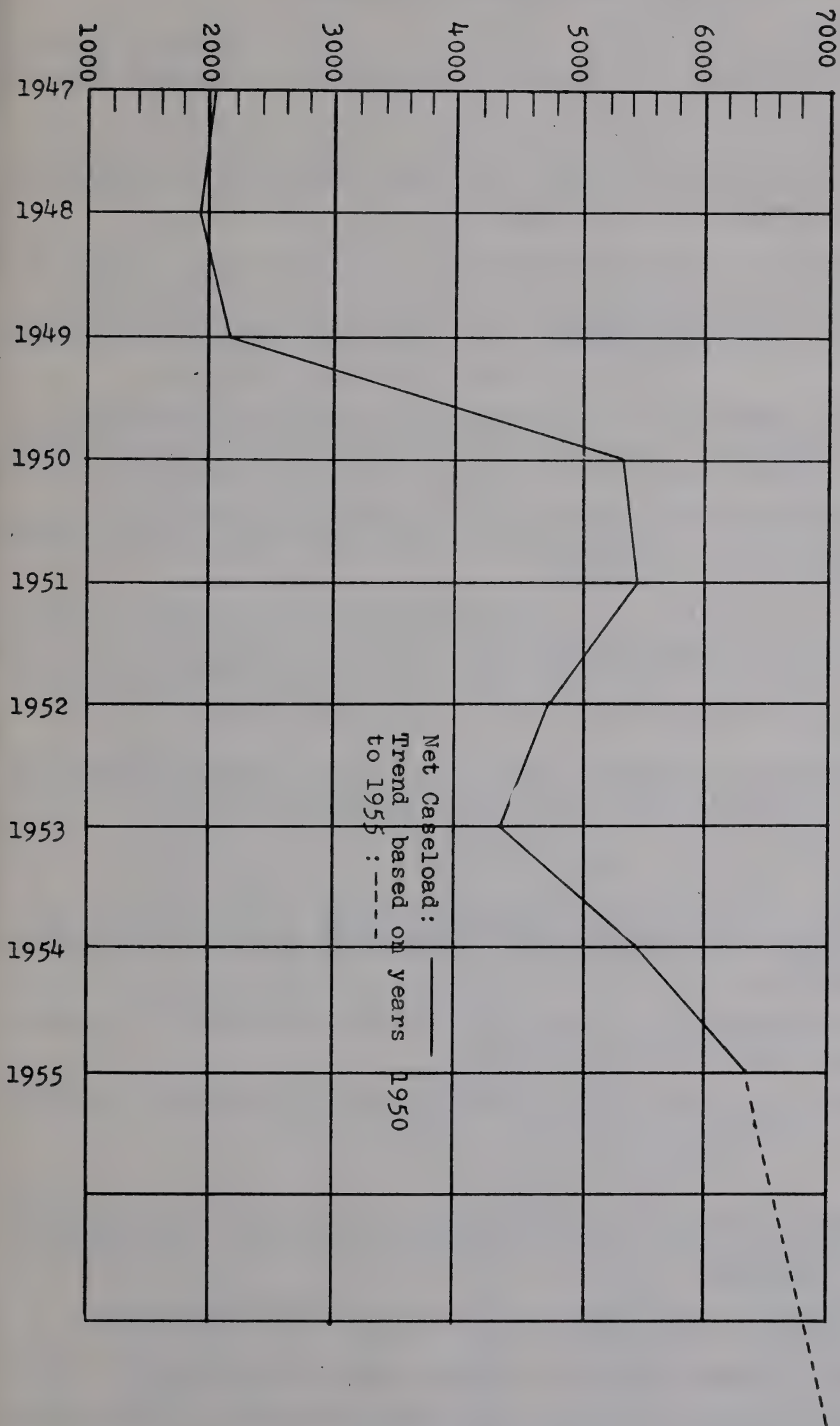
Beginning in 1949 the attached graph pictures a sharp rise from March 31st, when 5,889 persons were in receipt of assistance. This sudden rise was due to the introduction of The Public Welfare Assistance Act and amendments to the Home for Aged or Infirm Act authorizing grants to municipalities on behalf of those on assistance. The fall from 1951 to 1953 is not thought to be a normal trend but exists due to laxity on the part of municipal secretaries not submitting applications for grants during this period.

Taking into consideration the many reasons for the necessity of public assistance over an extended period and using the attached graph as a guide, it is our belief that a steady increase in recipients can be expected during the next twenty or thirty years. This, of course, in keeping with the rise in population.

Department of Public Welfare
DIRECT AND INDIGENT AND MEDICAL SERVICES

March 31st	Net Number	
1947	2,043	
1948	1,930	
1949	2,123	Due to Public Welfare Assistance Act.
1950	5,327	
1951	5,444	
1952	4,738	
1953	4,348	
1954	5,405	
1955	6,321	

Graph No. 11.



Department of Public Welfare
REHABILITATION AND RE-ESTABLISHMENT
METIS SETTLEMENT COLONIES

The Metis are enfranchized citizens of the Province in contrast to the Indian for whose welfare the Federal Government has assumed responsibility.

The majority of Metis prefer to live under communal conditions and the work of organizing communities for their welfare has been entrusted to this Department by the Government.

Six areas have been organized of which 5,905 acres are under cultivation. Expenditure of Government funds continues to decrease as the settlers become well established and as the Metis Trust Fund, built up from profits of commercial enterprises, is used for public services in the communities.

The Department has the responsibility of building and maintaining schools and employing the teachers. Thirteen classrooms are in operation and contain equipment and supplies comparable to the average rural school.

Health services are provided by visiting doctors and nurses, but it is hoped soon that an emergency hospital with a resident nurse in charge may be in operation in each colony.

The attached table shows the importance of this phase of departmental activity. It is expected that as the colonies become more self-supporting advantage may be taken of that clause in The Metis Population Betterment Act which permits them to be organized into Metis Improvement Districts.

So that others may benefit from our experience in handling the Metis problem, the following is given as an outline of our approach to this matter:

Problem:

- (a) Chronic insolvency due to inadequate background experience suitable to make this national group competitive under present modern conditions.
- (b) Inherited tendency to Tuberculine conditions probably due to change of diet from traditional foodstuffs.
- (c) Illiteracy of children due to strong nomadic tendencies of parents.

Objectives:

- (a) To provide the Metis population with employment suitable to their background experience and introduce occupations compatible to their capacities.
- (b) To make them solvent, first as a group, secondly as individuals.
- (c) Eradicate disease and the conditions that promote same.
- (d) Educate the young, not only in the three R's, but in sportsmanship, cleanliness and a desire to be useful citizens.

Solution:

- (a) Establishment of Government stores on Metis Colonies. These provide adequate and varied stocks of foodstuffs and good clothing, also act as paymasters in connection with work projects.
- (b) Establish sawmills and lumber yards for the commercial sale of lumber.
- (c) Construct schools and staff dwellings.
- (d) Provide adequate emergency medical treatment (nurse and small hospital).
- (e) Provide hospitalization plan whereby all members of Colonies may obtain hospitalization in Public Wards for \$1.00 per day paid by settler.
- (f) Pay for all logs and local improvement work in cash through stores.
- (g) Revenues obtained from all six Colonies by sale of natural resources (timber for the most part) are strictly earmarked for the Metis Trust and are deposited under two categories:
 - 1. **Natural Resources Revenue**—funds obtained from timber dues on sale of lumber to outside interests may be used for the benefit of **any** Colony, thus the prosperous Colonies, and those heavily endowed with natural resources, help take care of those Colonies less fortunate.
 - 2. **Commercial Revenue**—funds obtained from local businesses such as stores, butcher shops, sale of finished lumber (less dues) may be used on local Colony only.
- (h) Administrative authority is largely localized within the framework of regulations set up by this Branch.
- (i) All commercial enterprises are self-financing, no public funds being used.
- (j) Theatres are established as required and are used for educational purposes in conjunction with the schools. It is also found that the provision of local entertainment by way of good films gives the people an interest in life not available from any other source. Adequate entertainment also keeps the younger set out of trouble in the evenings. Education through pictures is more readily assimilated by the Metis than through written word or voice as their native tongue is essentially a picture language and their minds are attuned to this medium of education.

Province of Alberta
REHABILITATION AND RE-ESTABLISHMENT
METIS SETTLEMENT COLONIES
as at March 31, 1954

No.	Area	Families	Total Persons	Settlers' value of improvements		
				Permanent	Livestock	Equipment
1	Keg River	91	315	\$ 46,276.00	\$ 31,743.00	\$51,250.00
3	Big Prairie-Utikuma	98	382	24,193.00	21,816.00	16,675.00
4	East Prairie	26	101	10,036.00	5,346.00	4,415.00
7	Beaver River	93	380	37,486.00	37,147.00	14,500.00
8A	Wolf Lake	22	91	4,745.00	3,094.00	2,049.00
10	Fishing Lake	80	360	21,441.00	23,625.00	9,645.00
		410	1,629	\$144,177.00	\$122,771.00	\$98,534.00

Department of Public Welfare

INSPECTION BRANCH

The Inspection Branch of the Department of Public Welfare completes investigations for the several branches of the Department as requested by each branch. It is obvious, therefore, that a decline or increase in the services rendered by the branches, is reflected in the volume of work completed by the Inspection Branch. Thus, a discontinuation of any particular type of benefit or new legislation which makes provision for new types of welfare services, takes from or adds to the work of this branch.

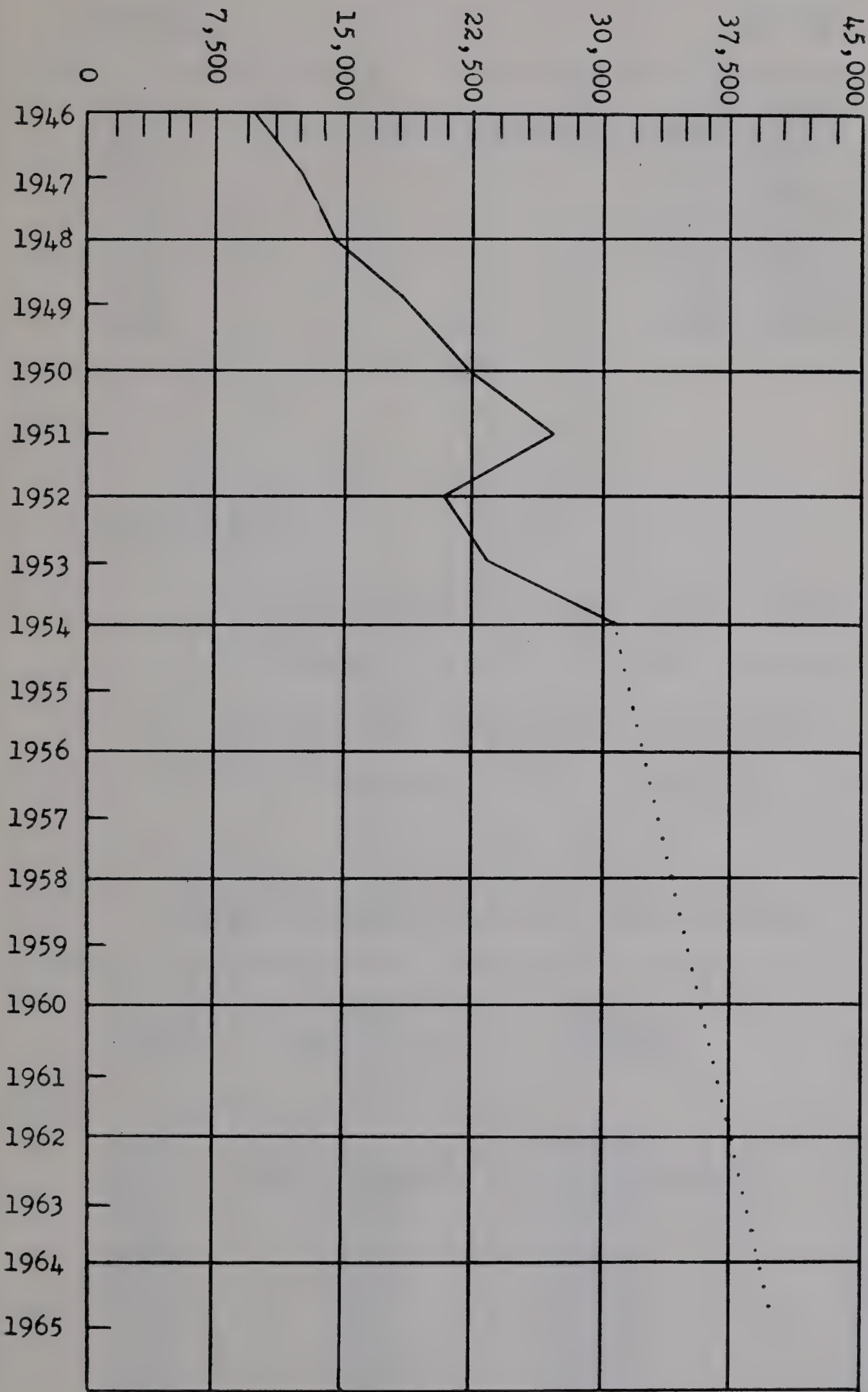
The accompanying graph beginning with the year 1946 indicates a fairly steady increase in the amount of work done to the fiscal year 1951-52 when a definite drop is registered. This is due to the fact that in that year the "Means Test" was discontinued with respect to persons in receipt of old age pensions who had reached the age of 70 years. As Inspections were no longer required for this group in determining their eligibility for pensions with respect to their financial circumstances, our field work was affected by this change.

However, persons who were 70 years of age and over and who were not in receipt of old age pensions from the Provincial Government could, after receiving Old Age Security benefits, apply to the Province of Alberta for Supplementary Allowance benefits. These applicants were subject to the "Means Test" and consequently were interviewed and a report submitted in each case to determine their eligibility.

At the same time, new legislation was introduced and passed which provided for a pension payment to persons in the 65-70 age group. As this group was subject to the "Means Test", the Inspection Branch was requested to complete investigations to determine the eligibility of the applicants and also their continued eligibility by a report at least once each year thereafter. Beginning May 1, 1952, payments were made to widows in the 60-65 age group and as this benefit was subject to the "Means Test", the Inspection Branch was requested to complete investigations for persons in this category. Again in 1953 legislation was introduced and passed providing for payment to disabled persons. The accompanying graph indicates, therefore, a sharp rise beginning with the year 1952 and continuing to the fiscal year 1954-55.

In view of the above mentioned new legislation, it is difficult to estimate the future trend to indicate the volume of work which this branch will undertake. However, on the basis of the average yearly increase covering the period 1946-1954 a future trend, projected twenty years, is shown on the accompanying graph.

Graph No. 12.



DEPARTMENT OF PUBLIC WELFARE
INSPECTION BRANCH

Department of Public Welfare

INSPECTIONS BRANCH

Fiscal Year	Number of Inspections
Apr. 1/46-Mar. 31/47	9,724
Apr. 1/47-Mar. 31/48	12,019
Apr. 1/48-Mar. 31/49	14,458
Apr. 1/49-Mar. 31/50	18,221
Apr. 1/50-Mar. 31/51	22,063
Apr. 1/51-Mar. 31/52	27,007
Apr. 1/52-Mar. 31/53	20,368
Apr. 1/53-Mar. 31/54	23,119
Apr. 1/54-Mar. 31/55	30,582

POPULATION AND NATURAL INCREASE—ALBERTA

Year	Population (estimates)	Actual Increase over previous year	Natural Increase
1945	808,000		13,485
1946	803,000	— 5,000	15,583
1947	825,000	22,000	18,088
1948	854,000	29,000	17,088
1949	885,000	31,000	17,852
1950	913,000	28,000	18,769
1951	939,000	26,000	19,836
1952	970,000	31,000	21,760
1953	1,002,000	32,000	23,539
1954	1,039,000	37,000	26,384
1955	1,066,000	27,000	

ALBERTA'S ECONOMIC PROSPECTS

DEPARTMENT OF PUBLIC WORKS

Compiled by:

Arthur Arnold, Prof. Eng.	Deputy Minister
R. Clarke, M.R.A.I.C.	Chief Architect
J. Hunt, B.Sc., Prof. Eng.	Chief Engineer
S. E. Kenworthy	Secretary to Department

DEPARTMENT OF PUBLIC WORKS

HON. JAMES HARTLEY
Minister

ARTHUR ARNOLD
Deputy Minister

I N D E X

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SUMMARIZATION

The Department of Public Works spent on maintenance and construction during the 30 year period April 1st, 1926, to March 31st, 1956, a sum of \$115,810,710.00. During the next 30 years, April 1st, 1956, to March 31st, 1986, it is estimated that this Department will spend \$484,100,000.00, or approximately \$16,137,000.00 each year.

The substantial annual increase in expenditure may be attributed to the following:

1. A steadily increasing population.
2. The necessity of providing facilities which were not provided for during the depression years and war years.
3. An expanding industrial economy with a resultant population trend from rural to urban centres.

The Department of Public Works of the Province of Alberta, is required to provide suitable accommodation, the necessary furnishing, and equipment, to all Departments of the Provincial Government, so that the Departments may carry out the various functions required of them. Such accommodation is provided in buildings rented, purchased or constructed by, or under the supervision of, the Department of Public Works.

For example, this Department provides fully furnished and equipped buildings such as:

- (1) Offices
- (2) Courthouses
- (3) Power Plants
- (4) Warehouses
- (5) Highway Maintenance Shops
- (6) Mental Homes
- (7) Home for the Aged
- (8) Hospitals
- (9) Gaols
- (10) Schools of Agriculture
- (11) Institute of Technology
- (12) School for the Deaf
- (13) University
- (14) Auditoria

The expenditure curve plotted on the chart for the years 1926 to 1955 constitutes a record of the monies expended for construction and maintenance by the Department during the period. The projected expenditure curve plotted on the chart for the years 1956 to 1985 is an estimate of the monies which we shall require for the construction of new buildings, the renovation of old buildings and the cost of general maintenance during the period. It should be realized that the Department leases accommodation under rental agreements where it is not possible nor expedient to provide accommodation by the construction of its own buildings. Such rental costs are chargeable to maintenance.

When determining the projected expenditure curve for the years 1956 to 1985:

1. It was possible to obtain close estimates of our construction needs during the next three years because the plans for the majority of the proposed buildings were already under discussion.
2. For the years 1959 to 1964 the projection is based on an estimate of the cost of those buildings which we know we shall be required to construct in order to reach eventually a modern standard of accommodation for all Departments of the Government.

One may observe, by a study of the attached chart, that the normal expenditures of the Public Works Department do follow to some extent the population curve. Where variations are evident, such are caused by Government policy or the non-availability of funds. For example, the curtailment of expenditures during the period 1930 to 1945 made necessary by the shortage of available funds, in the depression years of 1930 to 1939, and the shortage of labour and the materials during the war years of 1939 to 1945, required abnormal expenditures in the years 1954 to 1955. It is

anticipated that these abnormal expenditures will continue throughout the period 1956 to 1963 in order to compensate for the lag in construction during the period 1930 to 1945.

When plotting the projection for the years 1964 to 1985 consideration was given to:

- 1. Steadily increasing annual maintenance expenditures, because of the steadily increasing number of buildings that the Department will be required to maintain.
- 2. Major renovating of older type buildings.
- 3. Continued construction because of the steadily increasing population which will necessitate expanded Government services.

The estimated expenditure curve has a decreasing slope compared to anticipated population change, since it is felt that once stability has been reached, larger institutions rather than mere duplication of facilities would result in lower unit expenditures.

It should be realized that the fluctuation of the business cycle may seriously affect the anticipated expenditure curve. However, the need will exist and should monies not be forthcoming during any fiscal year, the ensuing years will be burdened in an effort to provided these needed facilities. Should a recession occur it is felt that the expenditures for public works be increased rather than decreased as a remedial measure for unemployment.

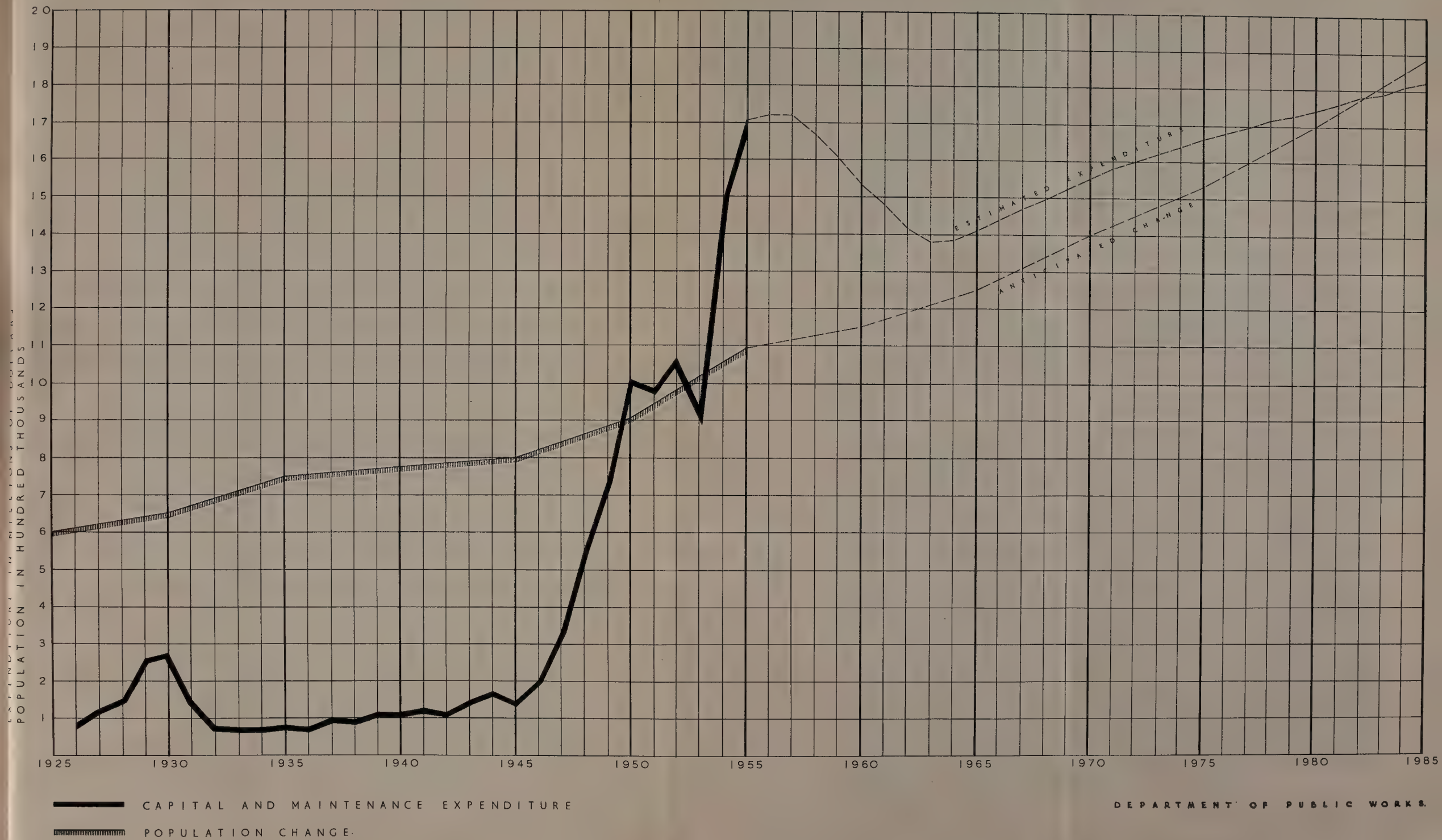
Actual expenditures for the period 1926 to 1955

Fiscal year	Maintenance	Construction	Total
1926-1927	582,244.00	270,170.00	852,414.00
1927-1928	743,567.00	524,631.00	1,268,198.00
1928-1929	632,118.00	895,341.00	1,527,459.00
1929-1930	708,606.00	1,888,588.00	2,597,194.00
1930-1931	761,315.00	1,985,781.00	2,747,096.00
1931-1932	752,223.00	643,904.00	1,396,127.00
1932-1933	699,488.00	97,651.00	797,139.00
1933-1934	654,640.00	75,944.00	730,584.00
1934-1935	690,424.00	39,422.00	729,846.00
1935-1936	686,736.00	109,854.00	796,590.00
1936-1937	688,093.00	67,403.00	755,496.00
1937-1938	705,607.00	295,940.00	1,001,547.00
1938-1939	760,944.00	201,158.00	962,102.00
1939-1940	765,120.00	403,770.00	1,168,890.00
1940-1941	840,741.00	303,859.00	1,144,600.00
1941-1942	774,675.00	510,899.00	1,285,574.00
1942-1943	836,067.00	310,153.00	1,146,220.00
1943-1944	896,199.00	548,957.00	1,445,156.00
1944-1945	960,869.00	755,294.00	1,716,163.00
1945-1946	1,113,578.00	336,482.00	1,450,060.00
1946-1947	1,147,838.00	868,475.00	2,016,313.00
1947-1948	1,333,295.00	1,991,388.00	3,324,683.00
1948-1949	1,603,731.00	3,912,128.00	5,515,859.00
1949-1950	1,666,281.00	5,732,282.00	7,398,563.00
1950-1951	1,860,598.00	8,244,480.00	10,105,078.00
1951-1952	2,056,604.00	7,797,622.00	9,854,226.00
1952-1953	2,324,458.00	8,366,048.00	10,690,506.00
1953-1954	2,769,251.00	6,592,666.00	9,361,917.00
1954-1955	3,306,627.00	11,615,171.00	14,921,798.00
1955-1956	3,725,447.00	13,377,865.00	17,103,312.00
	\$ 37,047,384.00	\$ 78,763,326.00	\$115,810,710.00

Estimated expenditures for the period 1956 to 1985

Fiscal year	Maintenance	Construction	Total
1956-1957	3,800,000.00	13,400,000.00	17,200,000.00
1957-1958	3,900,000.00	13,300,000.00	17,200,000.00
1958-1959	3,950,000.00	12,700,000.00	16,650,000.00
1959-1960	4,050,000.00	12,000,000.00	16,050,000.00
1960-1961	4,100,000.00	11,250,000.00	15,350,000.00
1961-1962	4,200,000.00	10,600,000.00	14,800,000.00
1962-1963	4,250,000.00	9,900,000.00	14,150,000.00
1963-1964	4,350,000.00	9,450,000.00	13,800,000.00
1964-1965	4,400,000.00	9,450,000.00	13,850,000.00
1965-1966	4,500,000.00	9,600,000.00	14,100,000.00
1966-1967	4,550,000.00	9,850,000.00	14,400,000.00
1967-1968	4,650,000.00	10,050,000.00	14,700,000.00
1968-1969	4,700,000.00	10,250,000.00	14,950,000.00
1969-1970	4,800,000.00	10,450,000.00	15,250,000.00
1970-1971	4,850,000.00	10,650,000.00	15,500,000.00
1971-1972	4,950,000.00	10,850,000.00	15,800,000.00
1972-1973	5,000,000.00	11,000,000.00	16,000,000.00
1973-1974	5,100,000.00	11,100,000.00	16,200,000.00
1974-1975	5,150,000.00	11,250,000.00	16,400,000.00
1975-1976	5,250,000.00	11,350,000.00	16,600,000.00
1976-1977	5,350,000.00	11,450,000.00	16,800,000.00
1977-1978	5,400,000.00	11,550,000.00	16,950,000.00
1978-1979	5,500,000.00	11,650,000.00	17,150,000.00
1979-1980	5,550,000.00	11,700,000.00	17,250,000.00
1980-1981	5,600,000.00	11,800,000.00	17,400,000.00
1981-1982	5,700,000.00	11,900,000.00	17,600,000.00
1982-1983	5,800,000.00	12,000,000.00	17,800,000.00
1983-1984	5,850,000.00	12,050,000.00	17,900,000.00
1984-1985	5,950,000.00	12,150,000.00	18,100,000.00
1985-1986	6,000,000.00	12,200,000.00	18,200,000.00
	\$147,200,000.00	\$336,900,000.00	\$484,100,000.00

CHART SHOWING POPULATION CHANGE AND CAPITAL & MAINTENANCE EXPENDITURE.



APPENDIX

Policy Recommendations of the Executive Council
of the Province of Alberta.

ENERGY, THE KEY TO INDUSTRIAL DEVELOPMENT AND NATIONAL WELFARE

It is axiomatic that industrial expansion and the effective development of natural resources depend on the availability of ample quantities of low cost energy, and that several related circumstances in the energy economy necessitate forward planning by Government and Industry if future energy needs are to be satisfied. Energy resources are physically limited and, except for hydropower, undergo drain through use. Much time is also necessary to bring some of these energy resources into production and even more time to supplement and/or substitute on a large scale, one source of energy with another. Further large scale investment funds and facilities are needed, whenever an increased total demand must be met through expanding of existing energy producing capacity or when the development of substitute sources of energy is necessary. Technological advances are steadily leading to increased efficiency in energy utilization and now point to new energy sources. But how soon advances in scientific knowledge will permit significant energy contributions from the atom, the tides, winds and the sun itself through direct use of solar energy is not now evident.

Recent significant increases in industrialization have been accompanied by population shifts as new natural resources come into development and as the productive capacities for others have been enlarged. It is evident also, that the per capita demand for energy is steadily mounting; this factor added to expansion in population from natural increase and immigration will undoubtedly lead to a tremendous growth in the future total energy requirement. These circumstances in combination require that Government and the energy industries endeavour to forecast and to provide for future energy needs on the most efficient basis possible. Indeed the complexity of the energy situation and the certainty of accelerating and great future energy demands suggest that such action is imperative.

Numerous private and several Government studies of energy requirements and supplies have been made in the United States in recent years. Among the reports on these investigations those of The President's Materials Policy Commission (Paley report) made to President Truman in 1952, and "Energy in the Future", a report prepared by Palmer Putnam for the Atomic Energy Commission, are undoubtedly the most thorough and extensive. Recognition of the fact that no such background of information with respect to energy source materials and energy requirements, is available in Canada, points to the urgent need for a comprehensive and detailed study of these subjects, by a high level technical committee and on a continuing basis, if Canada is to make effective use of its energy resources in the interests of public welfare, industrial development and national security both now and in the foreseeable future. Consequently it is recommended that:

- (1) A Canadian Energy Committee be appointed forthwith by the Prime Minister of Canada and be responsible to him.
- (2) The committee be composed of well qualified technical personnel selected, preferably, by the President of the National Research Council on the advice of a nominating committee of his choosing.*

* It is recommended that Committee personnel be chosen for high professional ability as the prime consideration, with reference however to geographical representation. Further, it is suggested that Committee members be appointed, half for a term of three years and half for a term of five years, at the end of term of appointed replacements could be made in line with the need for any special technical representation and for rotation from the point of view of particular association and geography.

- (3) The Committee be provided with specialist assistance as required and call on whatever source of information deemed essential for procuring data basic to a comprehensive and integrated study of the Canadian energy problem.
- (4) The committee be responsible for preparing a report on its studies and make recommendations as to those lines of action leading to the continuing availability of adequate quantities of low-cost energy.
The Committee report be presented to the Prime Minister of Canada and be made available by him to the Premiers of the Canadian Provinces who it is expected would consult with comparable provincial technical advisory committees, thereby enabling joint Federal-Provincial consideration and the ultimate initiation of policies as required in the public interests. The Committee report be printed and made available to industry and the public.
- (5) The initial report of the Committee and its projections be continuously revised in the light of the developing situation and technological advances through research and a revised report be issued when such is deemed advisable but in no event later than five years after the initial report. Future reports to be issued not more infrequently than at intervals of five years.

Continuing energy studies of the nature provided for in the above recommendations should enable private industry and Governments both to make the fullest and most economic use of Canada's total energy resources in the best interest of all Canadians.

INDUSTRIALIZATION IN WESTERN CANADA

The economy of Western Canada would be better balanced by increased industrialization. Steady payrolls and more uniform consumer purchasing power are essential. Since 1945 the Province of Alberta has had an active program of industrial development aimed at encouraging the establishment of new industries in Alberta.

It is suggested, to the Royal Commission on Canada's Economic Prospects, that the Government of Canada through the Department of Trade and Commerce, take a more active role in the encouragement of industrialization in Canada with emphasis on decentralization throughout all parts of Canada. A very minor effort in this field has been made to date by the Ottawa offices and a re-assessment of Canadian Government policy on this item would seem necessary.

Steady and successful efforts have been made in the trade field by Canada's Trade Commissioners. Trade Commissioners are ideally located for making contacts with industrialists who might be encouraged to establish branch plants in Canada. The plan of using Trade Commissioners to help promote the industrial growth of the country may also be the means of helping soft currency countries to earn dollars for the purchase of agricultural products from Canada. Once industrialists are introduced to the Canadian field, Provincial Industrial Development Officers are ready and well prepared to provide the necessary details on the Provincial and local level.

The attention of prospective industrialists should be deliberately directed to the whole Canadian field. Up to the present almost all of the new industries coming into Canada from Commonwealth and foreign countries have located in the Central Provinces. It is felt that in many cases the industrialists concerned have not had an opportunity to examine the industrial potentialities of other parts of the country.

Any diversification and decentralization of industry across Canada would be beneficial both nationally and locally. One important aspect to be considered is National Defence. New military bases have been widely

spread across Canada but facilities for National Defence production are still largely concentrated in one area. A similar condition exists in the location of Crown owned Corporations engaged in the manufacture of synthetic rubber and refining of uranium. In view of Western Canada, and especially Alberta, having an abundance of by-products from natural gas, particularly propane and butane, consideration should be given to the establishment of a section of the synthetic rubber processing in this area, close to the raw materials. The same would apply to the refining of uranium and other metals located in the North.

The advantages of having National Defence production more widely scattered seem self-evident and Government built defence plants at widely scattered points are indicated. Such plants might well form the nucleus for satellite plants quite independent of Government financing, with the final result of a spreading and decentralization of industry across Canada.

The seasonal unemployment problem is largely due to the slackening of construction activity during the winter months. At least a partial answer to this problem would seem to lie in an ever increasing industrialization program where year-round payrolls assume a greater proportion of the total labour picture.

In short, any Federal plan which would tend to equalize the industrial picture across Canada would be beneficial to the nation, and on this basis the Commission is asked to direct the Federal Government's attention to this problem. The Province of Alberta would be quite ready to co-ordinate her industrial development efforts toward this end.

HIGHWAYS

From the earliest days of recorded history, highways have played an important part in the progress of civilization and today the rapid development of transportation by motor vehicles has made the highway a factor of first importance in the economy of a country. Having in mind the important bearing that adequate transportation facilities have on the economic growth and development of Canada, we herewith put forward the following submissions:

(a) In recognition of the necessity of providing adequate transportation facilities in Canada, the Federal Government should prepare a plan that it is prepared to follow in building a network of national East and West, and North and South highways throughout Canada; the Federal contribution towards the costs of these highways should range from 90% to a lesser percentage depending on the national importance of same. The actual construction of the roads should be under the jurisdiction of the Provincial Government concerned, while the specifications, etc., should be worked out co-operatively by both Federal and Provincial Governments.

(b) The policy of the Federal Government of the United States should be studied with reference to the assistance granted by that Government toward the construction of Federal and State highways. This type of Dominion aid should be largely self-liquidating in the course of time by contributing to economic expansion generally throughout Canada.

(c) In order to facilitate and encourage proper development of the resources of Northern Alberta and the North West Territories and for the

purpose of encouraging tourist trade and capitalizing the assets of the Province represented by the National Parks, the Dominion Government should assume the responsibility of opening up the North West Territories, and part of the cost of the construction and maintenance of arterial highways to the North and to National Parks.

(d) Construction of good highways in the National Parks should be greatly speeded up. Canada is no doubt failing to capitalize fully on the scenic attractions of these mountain resorts.

DEPARTMENT OF AGRICULTURE

On the assumption that the benefits to be derived by the people of Canada from the Nation's economic prospects in 1980 will depend upon the development of her natural resources and the national policies adopted in every phase of her economic life, the Government of the Province of Alberta submits the following recommendations pertaining to agriculture for the consideration of the members of the Royal Commission on Canada's Economic Prospects.

1. In the interests of the development and conservation of the Nation's soil resources, the Government of Alberta recommends:—
 - (a) that a Federal-Provincial Advisory Committee on Land Utilization and Soil Conservation be established;
 - (b) that an integrated program of land utilization and soil conservation be developed on a basis to be agreed upon by Federal and Provincial Governments;
 - (c) that the Provinces be responsible for the implementation of the program agreed upon by Federal and Provincial agencies;
 - (d) that the funds necessary to give effect to the land utilization and soil conservation programs be provided from Federal and Provincial sources.
2. The Government of Alberta recommends that surveys be completed with a view to building upstream storage reservoirs on rivers rising on the Eastern slope of the Rocky Mountains to reduce peak water flows and store the water for use in the winter when natural flows are extremely low. Such surveys would indicate where storage sites are available as well as the details for their construction at the appropriate time. These developments would improve the supply of water for all uses and for the needs of the Provinces which depend on these rivers.
3. The Government of Alberta recommends that in order to insure the optimum development of the land resources, the National Treasury undertake to finance directly or through some form of Federal-Provincial policy a program of long-term credit for agriculture with provisions for the special requirements of young farmers and basing loans on approved farm management practices that are agreed upon between the farmer and a competent authority.
4. Inasmuch as the danger of introducing livestock diseases to Canada is accentuated by modern means of travel, the Government of Alberta submits that the specific responsibilities of the Federal and Provincial Governments in respect to the prevention and control of

animal diseases should be clearly defined and that the matter of Provincial embargoes against the movement of livestock, including the legal and financial responsibilities involved, should be determined.

5. The Government of Alberta acknowledges the contribution of the Government of Canada to the development of agriculture production and informational programs, but believes that without limiting the National application of these programs, their impact would be greatly increased if their detailed application within a Province might be mutually agreed upon by the Government of Canada and the Government of the Province concerned and the cost thereof shared on an agreed upon basis.
6. The Government of Alberta wishes to express its approval of the Canadian Vocational Training program as the latter applies to agricultural training and recommends that the program be continued in an effort to provide better trained young men to assume the responsibilities of operating the farms of the nation.
7. It has at last become evident to all of us that the present grain marketing policy cannot hope to solve the grain surplus problem.

The one hope of successfully marketing our grain would seem to be the adoption of a policy of expanding credit to consumer countries which will enable them to purchase our grain.

This can be accomplished in one of two ways:

- (1) Canada can extend credit, as such, realizing that the credit can be discharged only when our customers are able to raise dollars through world market sources, this credit to be extended for the specific purpose of buying surplus products at agreed prices.
- (2) We cannot accept payment in the currency of our customer countries, knowing full well that we must hold such currencies as reserves until such time as we find it in the interest of national economy to purchase such goods and services as the customer countries may have to offer. The price of such export grains must inevitably become a competitive one which will not encourage grain production on any other basis than high efficiency and economic soundness.

It is suggested that these same marketing policies will eventually have to apply to all those agricultural products of which we now have an embarrassing surplus.

CANADIAN TAX STRUCTURE

It has become increasingly evident that the entire tax structure in Canada is imposing a drag on industrial progress and needs a thorough overhauling with a view to encouraging the promotion and expansion of primary and secondary industries in Canada.

It is common knowledge that the impact of the present Canadian tax structure is such that often industry is penalized for expanding its operations or reorganizing. Furthermore there has developed a tendency to change rulings from time to time so that an air of uncertainty prevails, and it is becoming more and more difficult for tax experts to advise taxpayers on

their tax position in many cases, as for instance whether or not a profit is a capital gain.

The tax on real property is today the main source of revenue for municipalities and these taxes have already reached the danger point.

The situation is unrealistic and unhealthy and tends to retard the orderly and proper development of our natural resources.

We strongly recommend that an exhaustive survey of the tax structure in Canada be made in the immediate future. This survey should, of course, embrace all taxes, Federal, Provincial and Municipal.

Below we outline how present Canadian income tax law affects certain phases of the Oil Industry in Canada, namely, amalgamations and mergers of Oil Companies and depletion and exploration allowances applicable to the Oil Industry, all of which has a direct bearing on the National Economy.

We wish to emphasize that we are not advocating that Canadian Companies receive any special advantages over outside capital, but merely that they be allowed to compete on an equal basis in every respect.

AMALGAMATIONS AND MERGERS OF OIL COMPANIES

Within the last few years a number of amalgamations and mergers of oil Companies have taken place or been considered. Others are contemplated. These amalgamations seem to be a normal consequence of the development and growth of this comparatively new industry.

In the early stages of the industry a number of small Companies are formed with limited cash resources and comparatively small acreage to develop. Sometimes they expend their monies in the development of their own properties. Frequently they take small participations in the development of the properties of other Companies. Some of them prosper and expand greatly, and have no trouble in inducing new capital to participate in their ventures with the result that they grow into strong independent producers.

Others do not prosper to the same extent with the result that they find themselves without means to acquire and develop additional properties or to participate in the ventures of those more prosperous than themselves.

In some cases the share of market allowables accruing to these smaller Companies does not produce sufficient income to the Companies involved to permit an economic operation and produces nothing at all for expansion of activities, a situation which would be aggravated by cuts in allowable production or reduction of market prices.

Yet, Companies facing this situation may have sufficient production or potentially productive properties, or both, to be attractive to stronger Companies, who could handle their production on a more efficient basis and who possess the means to explore and develop the properties.

In these circumstances the obvious solution to the small Company's problem is to merge its assets and undertakings with those of a stronger company or for a group of smaller Companies to amalgamate, in each case with a view of reducing overhead and operating costs and providing

for the more efficient and economic development of the properties they control and for the provision of more adequate capital for the purpose.

Sometimes a new Company is formed to which the assets of the amalgamated Companies are transferred. Sometimes the assets and undertakings of one or more Companies are taken over by a Company already engaged in the business.

In practically all cases the merger results in the Shareholders of the merged Companies receiving shares of the new Company formed to take them over, or of the Company by whom the assets and undertakings are acquired.

There is no provision in the Income Tax Act by which such transactions may be carried out without the successor Company losing the benefit of the deductions allowed in respect of expenditures for drilling and exploration costs to which its predecessor or predecessors would have been entitled. This can offer a serious obstacle to an amalgamation which would otherwise be to the benefit of all concerned.

As the fairness and propriety of the present allowances for drilling and exploration costs is now conceded, it would seem equally fair and proper that means should be devised where the benefits of these allowances will not be lost to an amalgamated enterprise, particularly where, had no amalgamation taken place, the benefits of the allowances would have accrued to and been enjoyed by the predecessor companies.

The large major oil Companies are not affected to any extent. Those who suffer most are the smaller Companies, mostly Canadian. Here again Canadian capital is at a disadvantage compared with American Capital.

DEPLETION ALLOWANCES FOR OIL AND GAS WELLS

In Canada depletion is only granted after a Company has charged off all costs of exploration, which include ventures in any part of Canada. The Company may produce from a lease in one part of Canada and be exploring in another part a thousand miles away. It is becoming quite apparent that it may recover all the oil out of that Lease and never be able to claim any depletion for income tax purposes on this wasting asset. It would be more realistic to permit depletion to be claimed after the costs in connection with that Lease have been recovered, but disregarding expenses incurred in other parts of the country. This, for instance is the method used in the United States. United States Companies operating in Canada can claim depletion on Canadian properties on that basis for United States tax purposes, and, therefore, Canadian Companies are at a serious competitive disadvantage.

J. Gerald Godsoe, Vice-President of the British American Oil Company Limited stated in part at the 1955 Annual Meeting of the Company's Shareholders, "The present regulations prescribing the method for computing income subject to depletion have the effect of deferring any allowance in the case of a Taxpayer who continues to engage in an active exploration program to discover new reserves. In order to obtain an immediate benefit by way of depletion allowance under the present regulations, a taxpayer would have to abandon, or at least curtail, any further expenditures for exploration work, and confine his attention to the producing properties which he has already acquired. In other words, if a taxpayer continues to

search for new reserves, the very thing which the depletion allowance is intended to encourage and something very much in the best interests in the development of our country, he will, under the present regulations, be effectively prevented from obtaining any immediate benefit for depletion allowance." Mr. Godsoe also emphasized the important place of the United States depletion allowance (calculated on gross revenue) in development of Oil and Gas reserves in the United States and said, in part, "Authorities not fully sympathetic to the special problems of oil development, could set in motion, complex regulations detrimental to the industry and, in consequence, to the entire community."

EXPLORATION ALLOWANCES

United States Corporations can spend money on explorations in Canada and charge such costs against their United States income, so that they are in effect only spending fifty cents of their own money and fifty cents of Federal tax money. As a result of this, United States Corporations can operate as world wide companies and follow oil wherever they can find it. Canada confines the allowances for drilling and exploration costs granted to Canadian Companies to operations within Canada except for a comparatively minor exception and therefore Canadian Companies cannot compete on an equitable basis with American Companies in operations outside of Canada.

DOMINION MONETARY POLICY

The inadequate monetary policy on the part of the Dominion Government during the depression years operated with disastrous effect upon the Western Provinces. By ignoring the internal economy and permitting the external exchange value of the Canadian dollar to be influenced by that of the United States dollar, the internal situation in Canada was linked to the disastrous effects of the depression in other countries and the major burden of this was thrown upon the producers of the Western Provinces.

Western producers were forced to sell their products considerably below cost. They had to meet debt obligations which, in terms of their production, often amounted to one-third of the principal owed by way of annual interest alone and they received no return for their products to meet these charges. For instance, when the price of wheat (No. 1 Northern cash) fell to around 40 cents at Fort William, thus netting approximately 18 cents a bushel to the Alberta farmer, it meant that on an 8 per cent loan contracted when wheat was \$1.25, the farmer was expected to pay over 50 per cent interest in terms of production—but the price he received for his product was but a fraction of the costs of its production. Nevertheless he was compelled to pay high protected prices for machinery and household goods, increased as these were by the maintenance of high freight rates.

Alberta suffered the most by virtue of being a comparatively young Province which was rapidly settled and therefore had relatively heavy external obligations to meet. Also she suffered since being at the peak of transcontinental freight rates, she had to shoulder the resulting adverse effects on the prices of both her exports and her imports.

The complete collapse of the economy of the Western Provinces, which resulted was inevitable and was due largely to the failure of the Dominion Government to meet the requirements of the situation by means of a realistic monetary policy.

A monetary policy administered in the interests of the Nation is essential in Canada. What happened as above set forth in depression years must not be allowed to happen again. The Dominion Government has constitutional authority to govern currency and credit. It is generally recognized that the only concrete backing for either currency or credit is the body of consummable goods and the desirable services which the people are able and willing to produce and render. This suggests that a sound monetary policy must be one which so regulates the supply of currency and the flow of credit that the people of Canada can at all times have the means to procure and consume all they need or desire of the goods and services which Canadians are prepared to produce and render in abundance. It seems fair to assume also that this supply of currency and credit can be made available by other means than interest bearing loans. No other monetary policy is likely to regulate credit and currency in the best interests of the economic life of the nation.

